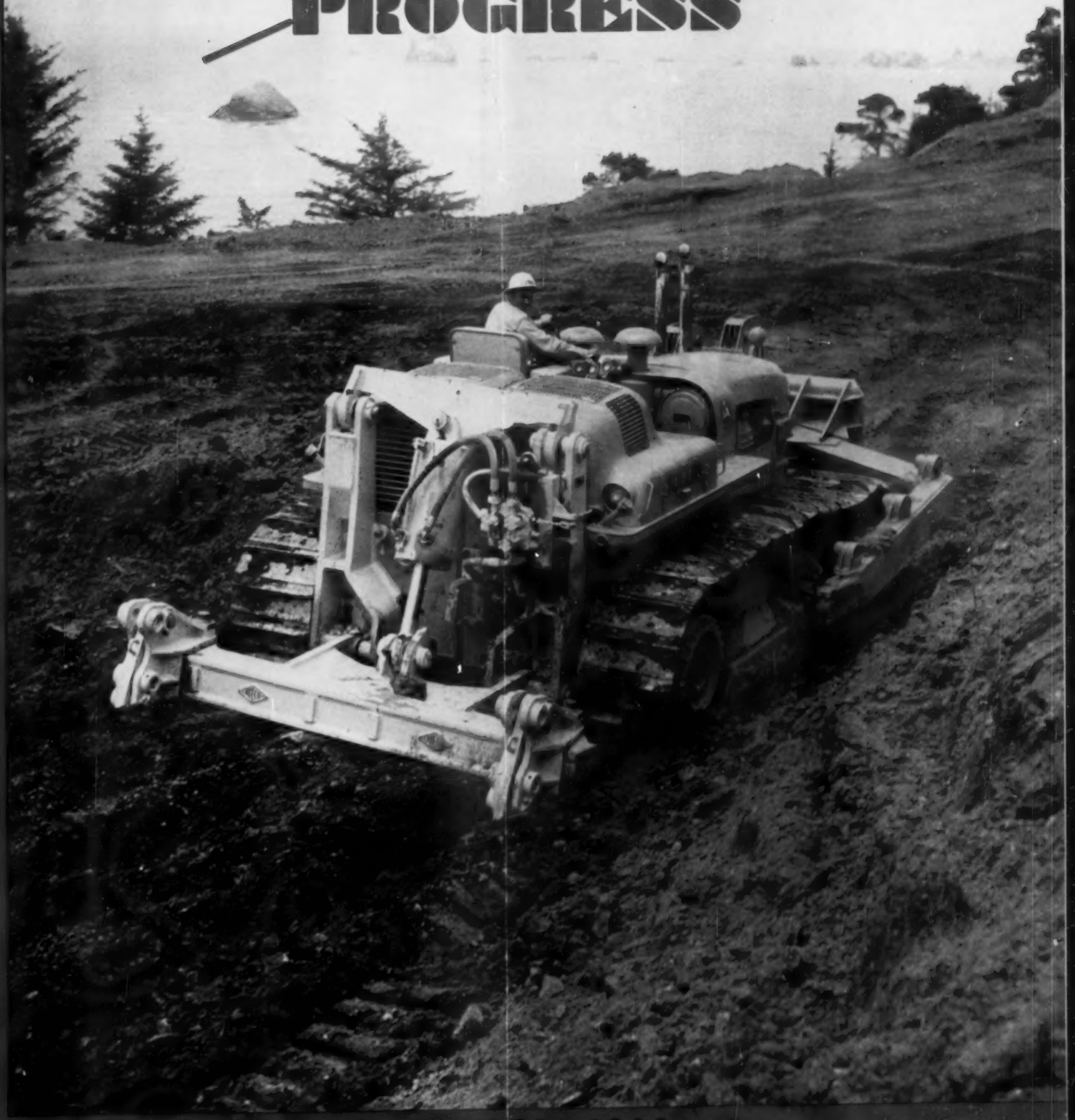
DIESEL AND GAS ENGINE PROGRESS

DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES



FIVE DOLLARS PER YEAR DECEMBER 1960 FIFTY CENTS PER COPY

WHAT'S IN THE FUTURE FOR DIESEL TAXIS?

Latest developments show engine builders aim for new market by hitting old problems of size and weight

Surveys undertaken by foreign and domestic firms alike indicate that American owners of light- and mediumweight fleets, faced with continuously rising operating costs, have developed into a very promising market for compact, lightweight, high-speed diesel engines. Performance records of various types of these vehicles, experimentally equipped with diesel engines, show that taxi fleets are among the most susceptible to important operating economies through dieselization.

Typical taxis travel an average of 20,000 miles a year in thick city traffic. This type of operation not only sends fuel consumption soaring, but also has proved, according to recent research, to be the most detrimental in terms of engine wear.

Leading engine manufacturers say they're tailoring the diesel to taxi operating routine by producing engines that, pound for pound, turn out almost as much horsepower as gasoline engines.

Diesel taxi experience to date

There are already several hundred diesel taxis operating in the U.S., and performance records of these cars appear to bear up diesel engine builders' contention that some of the diesel's greatest economy advantages are obtained in stop-and-go-service.

Some of the advantages cited by diesel taxi owners include lower operating costs (about 50% less); longer periods between overhauls (up to 500,000 miles in some cases) and less costly overhauls when they're needed.

How it's being done

Different manufacturers offer different solutions to the requirements of taxi service. One manufacturer predicts that the biggest initial expense item on diesel engines, fuel injection systems and fuel pumps, will be eliminated by mass production. Other manufacturers say they have been able to cut down on the first-cost of engines by maximum interchangeability of parts. Detroit Diesel, for example, reports using only three bore sizes for their whole range of diesels. Hercules claims to have brought initial cost down to about $15 per horsepower by designing all crankshafts for diesel loads, by using common blocks for both gasoline and diesel engines, and by standardizing on only two ring sizes, two piston sizes, and identical con-rods and bearings in all engines.

Builders say they get more power out of lighter engines by supercharging and turbocharging, and by making large components, like flywheel housings, of aluminum and other lightweight metals. The newest Hercules diesels are said to weigh only about 5.5 pounds per horsepower.

To keep 'em rolling

Engine builders and petroleum manufacturers have been working hand-in-hand on the problem of optimum lubrication for these new engines. Texaco, for example, has compiled an outline of lubrication recommendations designed to keep an engine as clean as possible for as long as possible. For information write:

Texaco Inc., *Fleet Sales Division*, 135 East 42nd Street, New York 17, New York.

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DIESEL AND GAS ENGINE PROGRESS

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FRONT COVER ILLUSTRATION

Euclid TC-12 Twin Power crawler, equipped with 2 GM 6-71 diesels and hydraulic ripper works on Oregon Coast Highway project for Morrison-Knudsen Co.

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"We are well pleased with our 21000," says Merle Giesey, partner in Aborigine Lumber Co.

Repowered with A-C 21000 diesel, gained 4 big benefits...

Several advantages were gained when this log loader at Aborigine Lumber Co., Fort Bragg, Calif., was repowered with an Allis-Chalmers 21000 diesel.

1. Plenty of power to handle variety of jobs easily — unloads 25 to 30 twenty-ton truck loads each 8-hr shift, sorts logs to various decks, feeds logs to mill, sometimes reloads trucks. Works steadily two shifts a day, six days a week.

2. Uses 20% less fuel—the previous engine used 60 gal. per shift, the new 21000 uses 47 to 48.

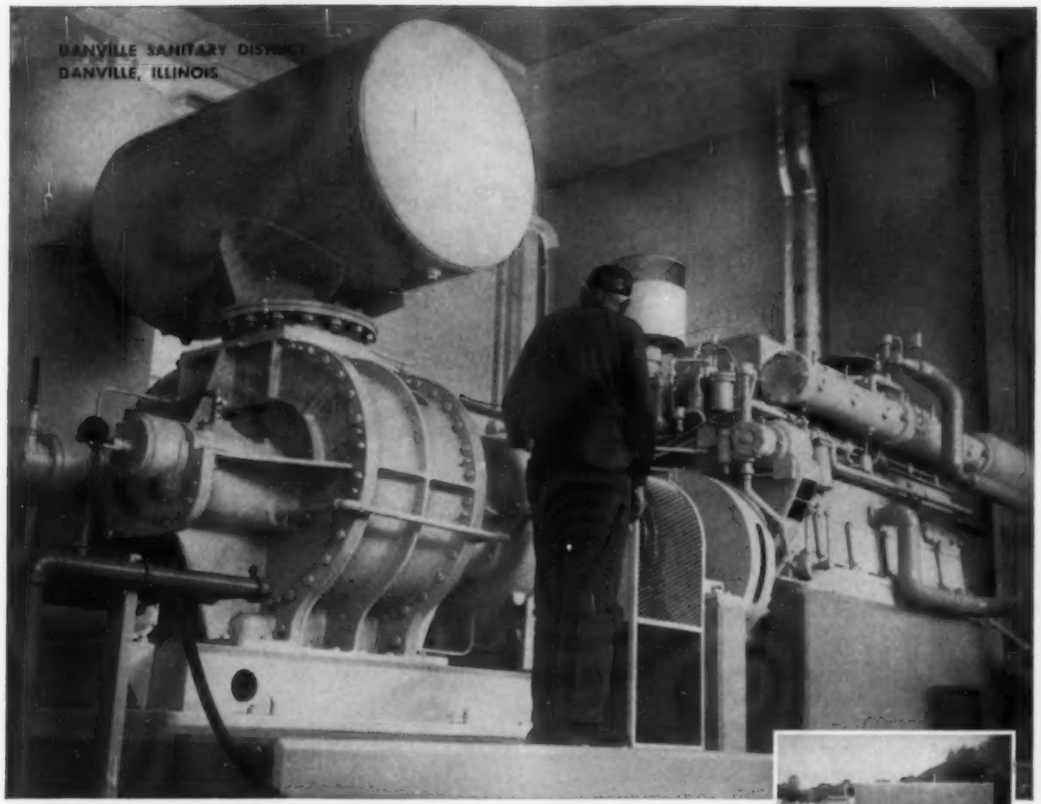
3. Starts fast — easy starting is important here, and the 21000 has it!

4. Has needed no maintenance, no attention whatsoever outside of regular oil change — not 5¢ worth of repairs. Such dependability is important when working in a remote area 200 miles from service facilities.

If you want benefits like these in *your* equipment, see your dealer about powering it with a modern Allis-Chalmers diesel. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS
POWER FOR A GROWING WORLD

BC-34



Cities Service DC-300 Oil operates

Blowers that can't afford to fail

If the huge blowers at the modern Danville sewage treatment plant should fail, aquatic life in nearby streams would be endangered, not to mention the time and expense of closing down the activated sludge plant to clean thousands of air diffusers in the outdoor aeration tanks. The powerful blowers (6000 cu. ft. of air per minute at eight pounds per square inch pressure) force air into sewage which is hungry for oxygen. Without the activated sludge treatment the effluent, when it is discharged in local streams, would rob aquatic life of life-giving oxygen.

To avoid downtime at all costs, Plant Manager Walter R. Glavey searched for the lubricating oil that would give the needed dependability. He says, "Since these engines were installed in 1958, they have run on DC-300 without a hint of failure due to lubrication problems. That's what I call dependability. We also appreciate the added safety factor of sending samples of the engine oil to the Cities Service Technical Lab in Chicago for testing."

If *you* are looking for dependability in lubricants, call your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

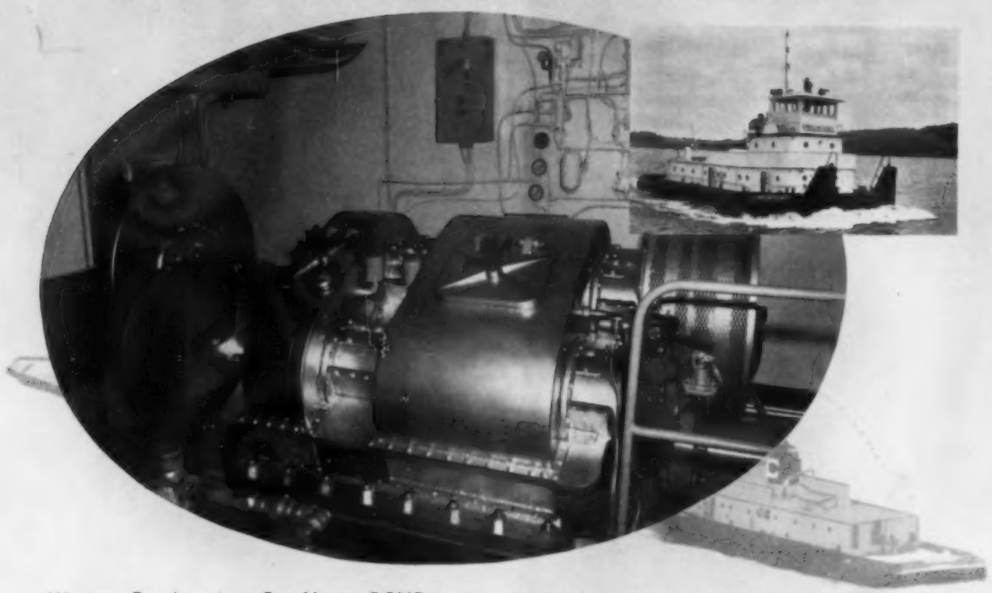
The Danville Sanitary District's sewage treatment plant is a model of modern architecture and efficiency. Cities Service DC-300 Motor Oil has been used without failure for engines, pumps, and motors since they were installed in 1958.

Plant Manager Glavey (left) and Cities Service Lubrication Engineer Jeff Combs discuss Cities Service lubricants used by plant. They include: Diesel Fuel, Trojan Greases for gears and roller bearings, Pacemaker Oils for hydraulic controls.

HOW WESTERN GEAR SERVES THE MARINE INDUSTRY

Another money-maker launched, carrying *Sea-Master*® WESTERN GEAR

PCMR Reverse and Reduction Gears



Western Gear's unique Sea-Master PCMR (pneumatic clutch marine reverse) gears were selected for the first push-type towboat, specifically designed for modern Hudson River requirements. ■ Launched at Dravo Corporation's Wilmington, Delaware yard, the "Rockland County" will push up to 20 loaded barges for Cornell Steamboat Company, subsidiary of New York Trap Rock Corp. The "Rockland County" is powered by two Fairbanks-Morse diesel engines which drive twin screws through Western Gear Model 80 PCMR-A reverse and reduction gears with Wichita pneumatic clutches.

HERE'S WHY WESTERN GEAR SEA-MASTER PCMR WAS SELECTED FOR "ROCKLAND COUNTY."

(1) Quill shaft drive, pioneered by Western Gear Corporation...
- (a) solves misalignment problems
- (b) provides "soft" drive for eliminating torsional problems

(2) Outside clutch location, pioneered by Western Gear Corporation...
- (a) provides better cooling
- (b) simplifies service
- (c) assures positive alignment through integral gear clutch mounting

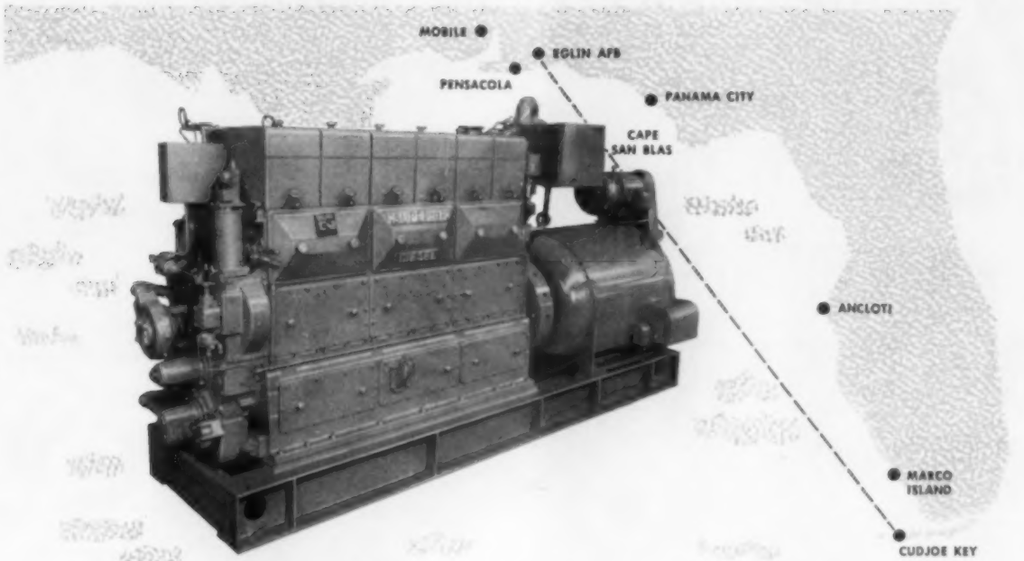
(3) Split-sleeve type journal bearings...
- (a) guarantee long life
- (b) allow easy inspection and maintenance
- (c) assure high efficiency
- (d) have proven dependability

(4) Simplified installation...
- (a) Exclusive Western Gear 3-point alignment system makes accurate alignment of gear housing, engine and propeller shaft easy.
- (b) Costly sub-bases, pillow blocks, stub shaft, etc. eliminated.

There's only one Western Gear Sea-Master PCMR gear. Accept no imitations or second bests.

For the full, unique story of PCMR, write, wire or phone for Marine Bulletin #5905. **WESTERN GEAR CORPORATION** Industrial Products Division, P. O. Box 126, Belmont, California. LYtel 3-7611

On the long run... **QUALITY COSTS YOU LESS!**



WHITE SUPERIOR ENGINES

help "keep score" at one of America's newest missile ranges

The Eglin Gulf Test Range (EGTR), consisting of five missile tracking stations, extends 450 miles from Eglin AFB, Florida down the west coast to Cudjoe Key, 23 miles east of Key West. At Eglin AFB and at three of the five tracking stations, power is supplied by White Superior Model 40-SX-6 engine-generator sets. Each of the five Superior engines on EGTR develops 361 BHP to produce 250 KW. At Cudjoe Key (shown below), two of the Superiors provide power for range safety equipment, trajectory measuring systems, drone control and telemetering devices, from which data is sent back to Eglin.

America's newest missile range joins an impressive list of Superior-powered U.S. defense installations, which include the "Texas Towers," portions of "DEW" line and the "SAGE" project, Atlas and other launching stations, and other missile tracking ranges. Government acceptance of White Superior engines for these installations is proof that Superior meets all requirements for rugged dependability, trouble-free maintenance and maximum fuel economy. Superior engines, from 215 to 2150 HP or 150 to 1500 KW, can likewise be custom-engineered to meet your exact requirements, including automatic, unattended or remote controlled operation. Write for complete information today!

Superior ENGINES ATLAS Imperial DIESEL ENGINES White DIESEL

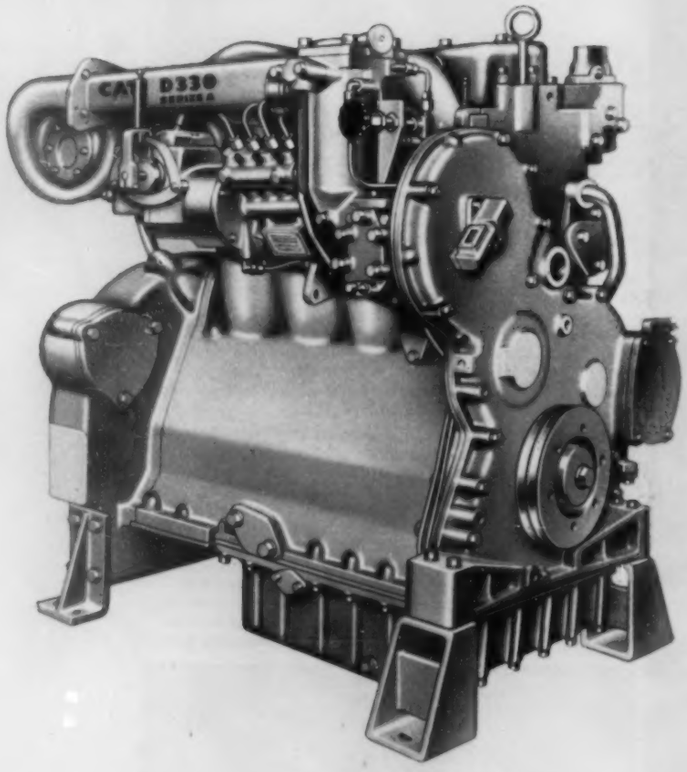
White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

U.S. Air Force Photos

- PROFITABLE POWER
- INCREASED CUSTOMER ACCEPTANCE
- MACHINE PERFORMANCE

THREE REASONS WHY THESE LEADING MANUFACTURERS OFFER CATERPILLAR ENGINE POWER IN THEIR EQUIPMENT



The D330, rated at 170 HP, is one of the new line of compact, lightweight diesel engines. With Caterpillar Engines in equipment, owners get four-cycle performance at no premium in price, plus the famed dependability and world-wide service facilities of Caterpillar.

Write for additional information about Caterpillar Diesel Engines and their application in original equipment.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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Name your engine

Chances are Koppers Piston Rings were installed by the original equipment manufacturer. More leading manufacturers select Koppers Piston Rings for their predictable performance and dependability. Koppers wide range of types and sizes . . . variety of materials . . . control of materials . . . close tolerance manufacture . . . rigid standards of inspection . . . *all* contribute to Koppers leadership in the field.

If you have a problem in ring application, avoid further needless expense and delay. Let us know the type of service (diesel, natural gas engine, dual fuel, compressors, etc.), along with the make and model of the equipment. Our engineers will send you the recommended set-up promptly. Write to: KOPPERS COMPANY, INC., Piston Ring and Seal Department, 6300 Scott Street, Baltimore 3, Maryland.

Koppers Porous Chromium-Plated Compression Rings are used extensively in many types of engines and compressors. Intensive tests have demonstrated that chromium-plated rings in the first or first and second grooves reduce cylinder wear one-quarter to one-third of that experienced with unplated rings. Where operating conditions or dimensional tolerances require a ring that will adapt itself readily to the cylinder, porous chrome-plated compression rings are the most popular type. For special conditions, Koppers also makes available dense, threaded or grooved face chromium-plated rings.

The **Koppers Tapered Ring** has a taper on its outside face of either 1° or 2°, depending on the size of the ring. It is used in gasoline, aircraft, gas and diesel engines, and in compressors because it seats-in more rapidly than other standard compression rings. This advantage makes it especially applicable to hardened or chromium-plated cylinders. In out-of-round or distorted cylinders, its ability to seat-in quickly helps prevent blow-by. It may be used in as many compression ring grooves on a piston as necessary; but, ordinarily, when a quick-seating ring is required for the top groove, a Grooved Back Ring or other special ring is used.

The **Koppers Seal Ring** has one band of bearing bronze rolled into a groove on its face. This band projects approximately .004" beyond the face of the cast iron ring. The ring seats quickly because high unit pressure is exerted on the narrow bronze band, preventing blow-by in new or worn cylinders. As the bronze wears, it burnishes the cylinder wall to a mirror-like surface and allows the cast iron body of the ring to reach a seat very gradually. Throughout the life of the ring, the bi-metallic surface serves more effectively to eliminate scuffing, improve lubrication, and reduce wear on cylinder, rings and piston. This ring may be designed to employ two bronze bands if specified.

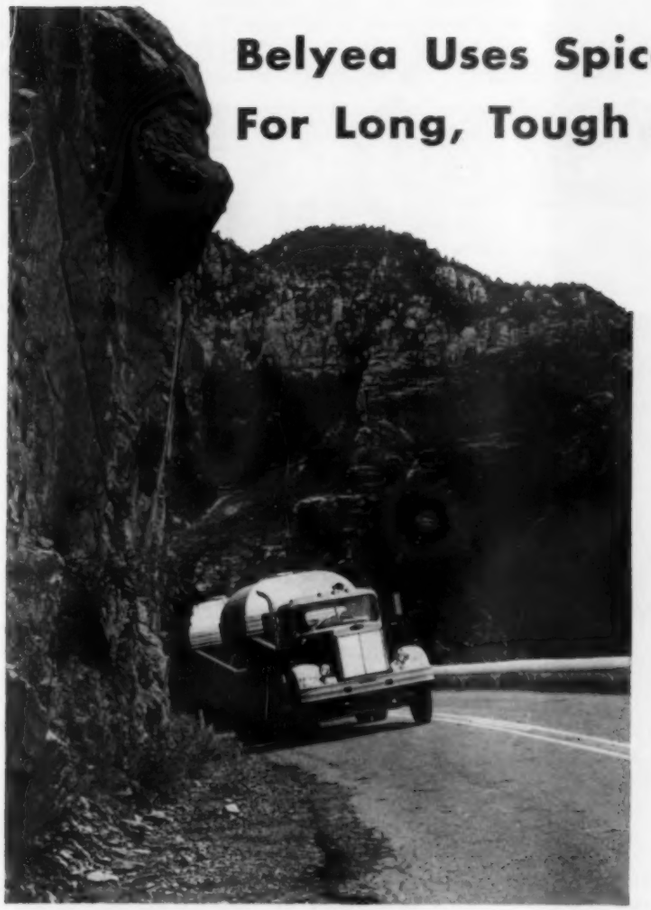
The **Koppers Grooved Oilcutter Ring** has a continuous channel around its outside face and a series of slots extending through the ring from the base of the channel; and the upper edges of the bearing surfaces are beveled to ride over the oil film on the upstroke. The lower sides of its scraping edges are undercut to form in each a small oil-collecting groove. The oil caught by the upper scraping edge drains through the slots in the ring. The oil caught by the lower scraping edge drains down the cylinder and through holes drilled through the piston from a drainage groove beneath the oil ring groove. The unit pressure of the ring keeps more nearly uniform; consequently, the efficiency of the ring is more constant.

The outer element of the **Koppers Conformable Grooved Oilcutter Ring** is made of cast iron sufficiently thin in cross section to permit maximum flexibility. The inner element is a coiled steel expander spring, the ends of which are butted together. Closed to cylinder size, the spring exerts uniform radial pressure against the ring, forcing it to conform to the cylinder wall although that surface may be neither round nor true. The spring has a low spring rate in order to prevent any appreciable change in pressure as the ring wears. The Conformable Oil Ring maintains a high unit pressure, uniformly distributed, throughout the life of the ring, providing better oil control. For certain four cycle engines, Koppers provides a notched Conformable Grooved Oilcutter Ring to provide more positive oil drainage.

AMERICAN HAMMERED®
INDUSTRIAL PISTON RINGS

Engineered Products Sold with *Service*

Belyea Uses Spicer Components For Long, Tough Mountain Haul



Part of a fleet of special Belyea tractor-trailer combinations whose grueling mountain haul is proving the efficiency and stamina of Spicer components.

John Sutherland, maintenance superintendent for Belyea's Glen Canyon Operation, checks one of the Spicer transmissions in the Belyea fleet.

High in the mountains of Arizona, Belyea Truck Company, of Los Angeles, is operating a fleet of Autocar trucks equipped with Spicer transmissions, clutches and universal joints on a rigorous haul which is dramatically proving the rugged, built-in quality of Spicer components.

The Belyea units are pulling double bottoms loaded with 54,000 pounds of cement over mountainous routes with grades up to 7%. The fleet is making forty 376-mile round trips daily, will run up in excess of 8,640,000 miles before the operation is completed. Temperatures vary from 20° below zero to 120° above.

John Sutherland, Belyea's maintenance superintendent, reports that the Spicer components are taking the heavy loads, steep grades and wide temperature variations in their stride – proof again that Spicer's engineering skill and precision manufacturing result in reliable performance, longer service. The transmissions are Model 8245 4-speed units with Model 8345-A 4-speed auxiliaries. 14″ 2-plate clutches and 1700 Series universal joints make up the other Spicer equipment.

For further information, write Dana Corporation, Toledo 1, Ohio.

DANA Spicer

DANA CORPORATION

Toledo 1, Ohio

New Board Meters

New 250-degree, circular-scale, switchboard a-c ammeters and voltmeters (Type KA-241) employing the taut-band suspension system are now available from the Westinghouse Electric Corp. The taut-band system uses no pivots or bearings and is free from rolling and sliding friction. These instruments withstand severe vibration and shock without effect on their accuracy. In the taut-band construction, the moving element is supported at each end by high-tensile metal bands. The bands are permanently anchored to the moving element of the instrument and to U-shaped springs that maintain proper band tension and contribute to immunity to shock and vibration. Small stops prevent excessive axial and radial movement as a further measure of shock-proofing. Moreover, the voltampere burden of these new instruments is lower than the pivot-jewel design—the voltmeter is only 40 per cent and the ammeter is 28 per cent of the corresponding, conventional pivot and jewel-type instruments. For further information, write Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa. (ITS NEW)

Self-Cleaning Filters Catalog

The Cuno Engineering Corp. has released a new 16 page catalog on its line of Auto-Klean and Super Auto-Klean filters. The catalog contains a complete listing of these all-metal, edge-type units which do not require cartridge replacement. A cut-away view is provided to demonstrate their self-cleaning action, and also a filter selector chart and a complete set of flow tables. Copies of this catalog, no. 51-100, may be obtained by writing to the Advertising Department, The Cuno Engineering Corp., 80 S. Vine St., Meriden, Conn. (ITS NEW)

Band Clamp Catalog

Now available is Marman's new 44-page industrial catalog No. 803 containing full product information on a complete line of industrial band clamps, hose clamps, couplings, flanges and V-band joints for all types of applications. Complete design information is given for engineers designing original equipment. Comprehensive product dimensional and operating data provide design engineers with important facts and advantages needed in original product design work. While the catalog is designed especially for design engineers in the original equipment field, the products featured are also used in the industrial replacement field and are available from local Marman distributors. For a free copy, write Aeroquip Corp., Marman Division, 11214 Exposition Blvd., Los Angeles 64, Calif. (ITS NEW)

M.A.N. Repair Base in Rio

With repair bases in Hamburg, Calcutta and New York, M.A.N. has announced the establishment of a fourth station, this in South America. In Rio de Janeiro an agreement was concluded with Messrs. "Companhia Comércio e Navegaçao" (CCN) who execute all repair and overhaul work in their shipyard "Estaleiro Lahmeyer" Niteroi in Guanabara Bay. The machine shop of the shipyard was completely modernized with the technical aid and support of the M.A.N. and equipped with German machine tools for manufacture of spare parts.

GM Diesel Distributor

Lawless Brothers, Inc. of Bakersfield, California has been appointed distributor for engines manufactured by Detroit Diesel Engine Division of General Motors Corporation. The newly appointed distributor will handle GM diesel sales, service and parts in their territory. Heading the new distributorship are Thomas E. Lawless, president and general manager, Frances E. Lawless, vice president, and Francis N. Lawless, secretary-treasurer.

EMD Staff Changes

Electro-Motive Division of General Motors, La Grange, Ill., has announced a series of top management changes following the transfer of R. H. Bish, Works Manager, to a new assignment in the General Motors Technical Center, Detroit. George D. Baker, formerly assistant works manager, has been named manufacturing manager in charge of all manufacturing operations. Other changes include John H. Anderson, director of test and inspection, named manager of manufacturing facilities; Robert A. Stoddart, manager, branch operations, named manager, production control; W. N. Fritts, former manager, production control named manager, branch operations; and H. D. Dana, assistant director of test and inspection, named manager, quality control.

Truck Cost Record Book

Truck cost record books and forms for driver daily reports to assist truck users in evaluating the performance of their equipment are being offered free by the motor truck division of International Harvester Co. The truck cost record book consists of 20 pages, and each book allows an accurate record to be kept of all fixed, operating and maintenance charges against one truck for one full year. The driver daily report may be used in conjunction with the truck cost record book. It provides space for reporting information such as number of trips, trip time, number of stops, mileage, loads, and fuel and oil consumption. To obtain copies, write to Consumer Relations Department, International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. (ITS NEW)

Brochure on Research

A new eight-page brochure, entitled "Looking Ahead," tells how research and development constantly strive to make today's machines better and at the same time works on the machines of the future. Research and development activities of the Caterpillar Tractor Co. Engineering Department, Research Department, Product Division and Market Division, all aimed at producing the most versatile machinery with the best materials available are discussed in detail in the brochure. Copies of "Looking Ahead" may be obtained by writing to the Advertising Division, Caterpillar Tractor Co., Peoria, Illinois, and requesting Form No. D023. (ITS NEW)

J. K. Hampton Retires

J. Kenneth Hampton, manager of the Washington office for the Detroit Diesel Engine Division of General Motors Corp. retired on August 31 after 14 years' service. Mr. Hampton will be retained by the firm as a consultant. He joined Detroit Diesel in 1946.

Clark Bros. Appointments

Clark Bros. Co. has announced the following appointments in its Houston and Los Angeles District Offices: John W. Jennings, formerly application engineer, Houston, has been promoted to sales representative-small engines for the same district. John L. Spencer, appointed application engineer, Houston District office, reporting to Mr. J. Y. Allen, district manager. James O. Campbell formerly application engineer, Turbo Marketing Dept. at Clark Bros. headquarters in Olean, has been transferred to the Los Angeles district office as Application Engineer.

DIESELS GO TO SCHOOL

Economies of Operation and Maintenance, Fewer Stops for Refueling, and Longer Service Life Justify Diesels for School Buses

By JAMES JOSEPH

ALONG a rural road plies a familiar blob of orange . . . a school bus. Expertly its driver wheels to a crossroads, picks-up half a dozen moppets, then shuttles another mile to another junction—and more kids. At the wheel is a mite of a woman. And behind her ride 80 school-bound kids—kids who, like that lady driver, are riding a trend: for underfloor is a diesel engine.

The trend toward school bus dieselization is gaining momentum—and some vocal boosters: Says superintendent Robert Elliott of California's Lakeside Union Elementary School District, ". . . we are getting between 7 and 8 miles per gallon with our diesels compared to about 3½ for our large gasoline powered buses." "Figuring we travel 25,000 miles per year per bus," says another school authority, "and that diesel fuel costs 19.7 cents per gallon, gas 20.4 cents a gallon, we come up with a total saving of $722.17 per year per bus."

The trend, though apparently strongest in California is reaching cross country as well. "Dieselized school buses," says a midwestern educator, "have solid backing from our School Board." That they have explains away a fallacy which has long equated diesel economy in terms of long runs and heavy loads.

Quite the contrary are the facts of school bus operation:

1. The average school bus puts but 12,000 miles annually on its odometer.

2. School bus operation is essentially a stop-and-go type of service.

3. Gross weight more often approximates 30,000 lbs. than the 70-80,000 lbs. common to OTR rigs.

4. More and more, the "fellow" behind the school bus wheel is no fellow at all, but a pert

Big Crown Supercoach, its Cummins diesel concealed midships and underfloor, serves desert Trona (Calif.) Unified School District. Driver is Mrs. Sue Teel.

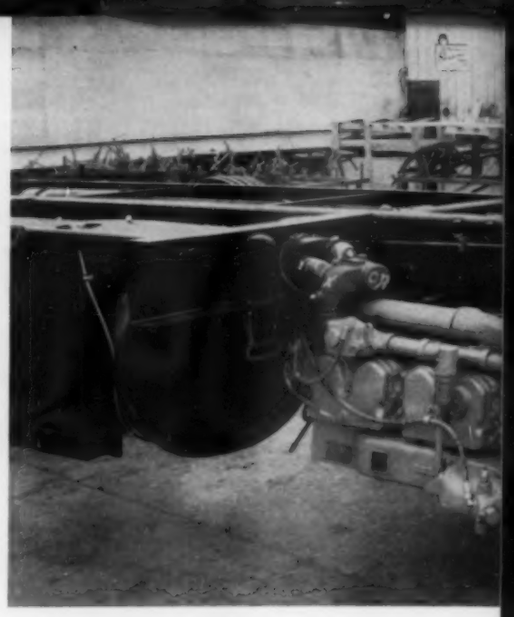
lady driver. And, as such, not "schooled to driving economy"—at least by masculine definition.

Yet, the ladies are taking enthusiastically to diesel buses. And so are their School Boards. And both with reason: The fact is that diesel buses, despite stop-go driving, low annual mileage and short runs, are racking up economies which few economy-minded school boards can overlook. "Which explains," says Charles F. Koors who is manager of sales promotion for Crown Coach Corporation, a big western school bus builder, "why about 60 per cent of our buses go out of here dieselized." Koors figures that at least 200 dieselized Crown Coaches, many of them the company's big transit-type, 79-passenger Supercoach, are now plying school routes, a goodly number in California. And a surprising lot of them are assigned not to rural roads but to city streets.

The deployment of an ever-growing number of school buses to in-city service is itself a trend: city traffic has become so hazardous and many a city school's "pupil area" so extensive, that nowadays many a big city school operates as many buses as its rural cousins. The State of California, for one example, re-imburses local school districts for bus-transportation, the percentage of reimbursement depending on the pick-up distance from school and various other factors. Districts may furnish bus-transport for all kids, regardless how far they live from school. The State, however, chips in only for youngsters transported from outside a given radii. Thus, the state may partially underwrite bus pick-up of kindergarten-thru-3rd graders who live more than ¾-mile from the school yard. Junior highs may get state support when they bus-in kids living farther than one mile. High schoolers home-based two-miles from their hall of ivy may have some or all of their transport paid from state funds. Underwriting this complex transport set-up is an equally complex "reimbursement" schedule, state-sponsored. Depending on distance, local tax rates and assessment valuations, the state may pick-up much or all of the bus tab. And, in certain cases, it picks up none at all.

At least one reason some school boards are taking a more careful look at heftier, more economical and longer-lived school vehicles is the "reimbursement" formula, operative in some states, which decrees that the state won't underwrite new school buses . . . unless the old have put in a decade or *more* service. Some states decree 15 years' service life for the average school bus. Run a bus a decade and a half, and state educational authorities may OK purchase—and state underwriting— of a new one. Obviously, school heads are looking for long-run economy . . . heavy-duty engines which need but minimum repair and overhaul over the years, bus bodies which are still serviceable after a decade or more . . . buses with capacity to handle today's already big loads and the bigger ones to come. Concedes Crown's Koors, "all these aims favor the maximum capacity, custom coach . . . and the diesel engines we're putting into an increasing number of them."

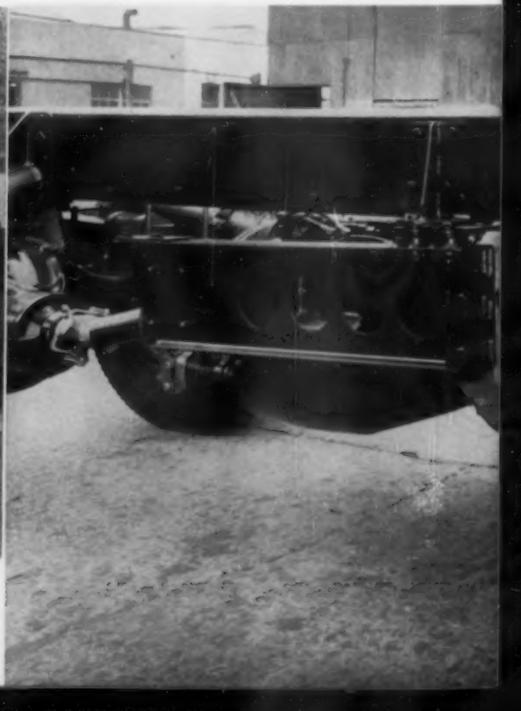
Crown's Supercoaches tuck Cummins' "pancake" NHH-195 (672 cu. in.) or NHH-220 (743 cu. in.) midships and underfloor, the engine's out-of-the-way locale boosting seating capacity anywhere from 8 to 30 per cent. Typically, Crown's Cummins diesels work thru Fuller 5-speed constant mesh transmissions (notably Fuller's models 5C-65 and 5C-72). "Power inherent in the two Cummins 'pancake' engines," explains Koors, "means that usually only four speeds need be routinely used . . . and that means less shifting for women drivers." Why not automatic transmissions? Generally, say most school bus makers, school men balk at the extra cost, though a few insist on automatics.

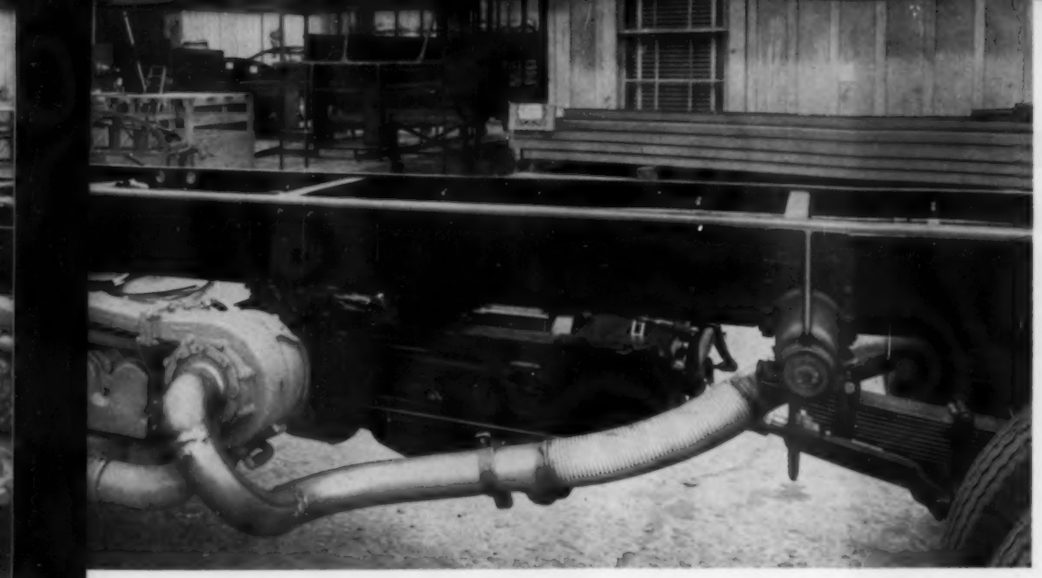


The noise differential—diesel engine versus gasoline—has, on most dieselized buses, been effectively muffled thru insulation. Crown coaches, typically, have what amounts to a double floor, the "sandwich" space between installed with upwards of ¾ in. of fiberglass. Crown designers, though they as readily install gasoline as diesel engines in their coaches, are enthusiastic diesel boosters. Crown is particularly enthusiastic dieselwise when it comes to its big transit-type 79-passenger school bus, powered by either of Cummins' two heavy duty diesels: the Cummins NHH-195, six cylinders, with a bore of 4⅞ in., a stroke of 6 in., and rated 195 hp at 2100 rpm; or the Cummins NHH-220, six-cylinder, with a 5⅛ x 6 in. bore and stroke, 612-ft. lb. torque at 1600 rpm, and rated 220 hp at 2100 rpm.

Though not many big dieselized transit type school buses are ordered with automatic transmissions, most are otherwise fully power-equipped. Crown's Supercoaches come with Ross power steering, have Crown Kontrol adjustable-pitch 6-bladed fans (which work behind side mounted fin-and-tube radiators), have power actuated Westtinghouse air brakes and emergency braking.

Trend is toward "transit-type" school buses, as this diesel-engined one with 79-passenger capacity for Capistrano Beach School District.





Side view of typical transit-bus chassis illustrates turbocharger mounting and exhaust piping arrangement.

Diesel fuel economy is not the only reason school authorities are taking a longer look at more-miles-to-the-gallon diesels. Just as important is the fact that bonus mileage means fewer refuelings. "Stop with a bus load of kids," winces one lady driver, "and you've got problems—and kids—on your hands." Another frequent-refuel problem: drivers on extra-duty trips have to carry school funds or pay for fuel out of their own pockets, then hand-in a fuel receipt for reimbursement. Says Trona Unified School District driver Mrs. Sue Teel, who pilots a 79-passenger dieselized bus for the California desert community, " . . . we get nine miles per gallon from (diesel) fuel whereas the best of the gasoline powered buses will only get five miles per gallon . . . so we use the diesel bus on all the special trips. Once I took a load of drama students to the Pasadena Playhouse, a round trip of about 350 miles. We didn't have to stop . . . and go to the trouble of refueling." Mrs. Teel's Crown Supercoach packs a Cummins NHHB-6 200 hp diesel underfloor and midships.

Some school districts have recently begun conversion of gasoline rigs to diesel. Most conversions are the so-called "conventional" coaches (the hood-and-fender variety with engines upfront). "Still," agrees a diesel advocate, "it takes some doing to sell 'diesel'." One reason it does is that admittedly diesel first costs come higher than comparative gasoline power. One maker figures his maximum-capacity, school coach, dieselized, costs $1,000-$3,-500 more than the same coach, gas-engined but squares this differential in long-term savings.

Item: Fuel savings . . . at least 4-miles per gallon more over a bus' average 12,000 mile annual run, thus 1500 fewer gallons a year. Savings amount to at least $300 per year, to $3000, nearly the cost of dieselization, in ten years. But this coach-maker, hawking a customized, built-to-last body, claims a minimum 20-year lifespan, which is both music and money to economy-minded educators.

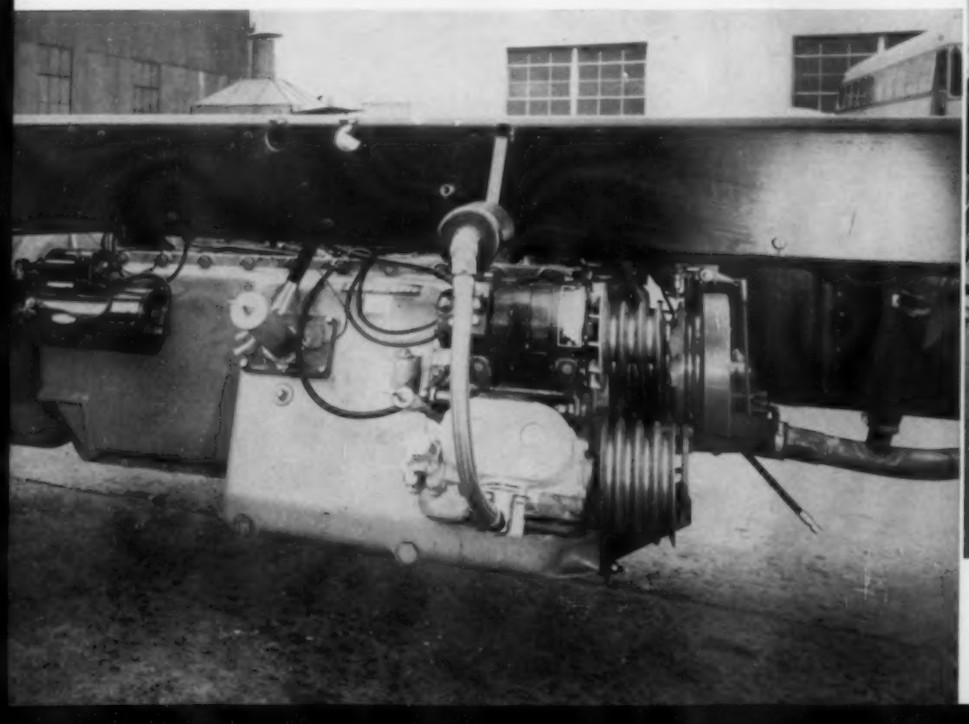
Item: Maintenance costs cut in half and, with it, down-time minimized. Both—less maintenance and fewer off-road shop hours—are important to the average school district which seldom has buses enough as it is. To keep buses, and schools, scheduled school authorities must literally keep their coaches on the road, not in the garage. One diesel advocate figures—and conservatively so—that with diesel maintenance 50 per cent that of gas operation, a school should save no less than $2000 over the decade, shave hundreds of hours from down-time.

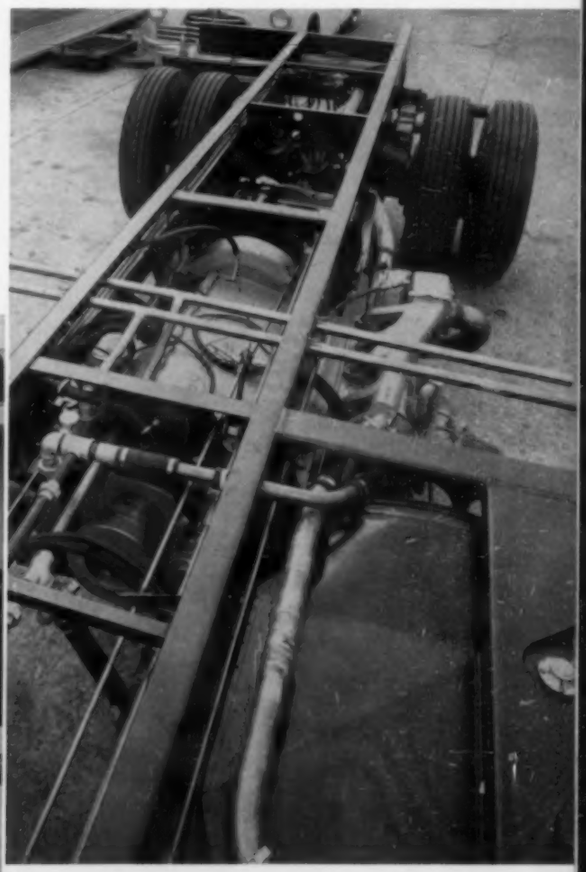
Item: Stop-go economy and longer engine life. Stop-go economy is inherent in the diesel cycle. Minimum fuel injection when idling means less fuel dilution, less internal engine wear . . . that, and longer-lived engines, lower fuel bills.

But perhaps a school official best summed up the trend toward dieselization when he said recently, ". . . as I see it, the diesel cycle is here for school buses and we might as well prepare ourselves for it. My own school board is 100 per cent for the idea, so much so that we have already put in a 10,000 gallon diesel storage tank and pump." Many another school district is following suit as diesels go to school.

Photo shows diesel-installed chassis of big transit type bus and 70-gallon diesel fuel tank. Timken rear axle is used.

Here's how typical Cummins diesel is mounted underfloor, its cooling system geared to side-mounted radiator. This is Cummins turbocharged NHH-195. Complex of belt drives operates various power equipment. Transmission is Fuller and starting motor, Delco-Remy.





GAS ENGINES POWER THERMAL PROCESS PLANT

By DWIGHT P. ROBISON

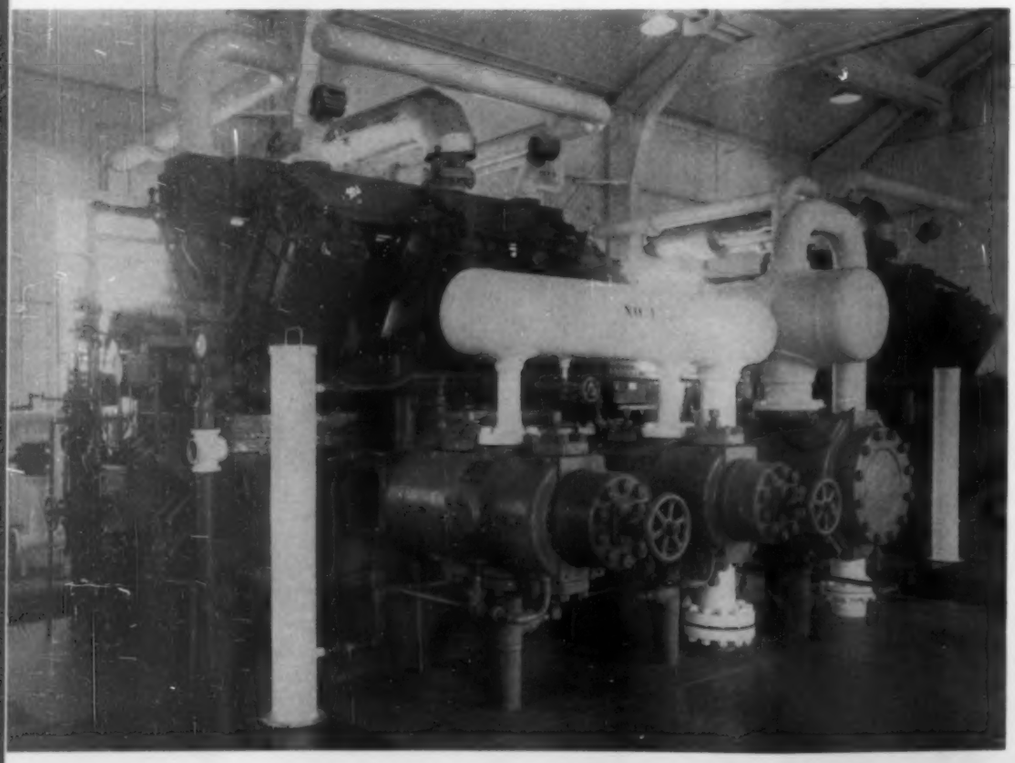
A $3-million natural gas processing plant, operated by Warren Petroleum Corp., near the north Texas town of Bridgeport and using nine Ingersoll-Rand natural gas engines, is demonstrating the efficiency of thermal distillation. The plant, owned by CM&M Gas Products Plant Inc., sits astride the outlet line of one of the nation's newest and biggest gas fields. It represents the culmination of half a dozen years of development work in Wise County, Texas, by Christie, Mitchell & Mitchell, Houston oil and gas company. Accomplishments have been impressive since 1952 when CM&M acquired a mediocre gas well and 2,000 acres of mineral leases in the drought-plagued county. Today there are more than 175 gas-producing wells and 75 oil wells on 400,000 leased acres covering much of Wise and part of Jack County. It is anticipated that eventually 800 wells will be drilled in the area.

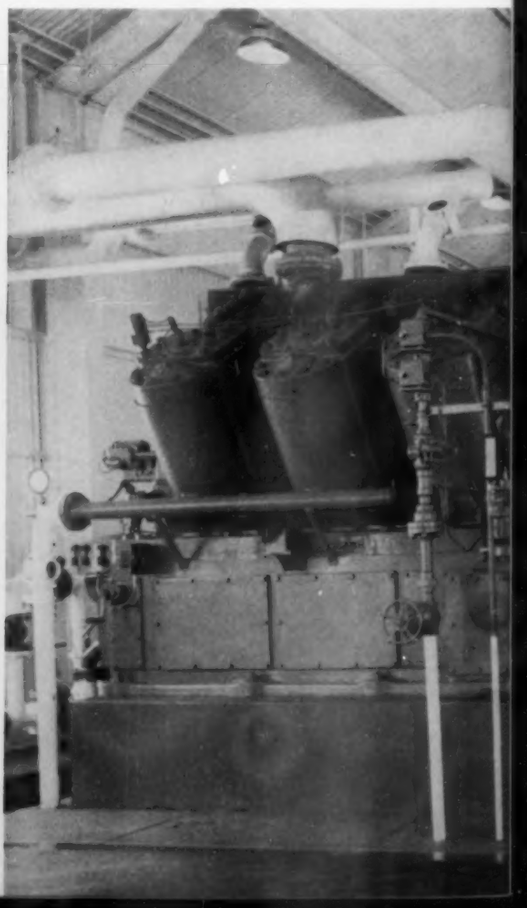
Associated companies entered the picture to fulfill two essential elements in the master plan. To get gas to market, Natural Gas Pipeline Co. of America built a gathering system and a connecting line to its main pipeline serving the Chicago area. To strip liquid products from the wet gas, Warren Petroleum Corp. cooperated on design and construction of a stripping plant and agreed to operate it and sell its products.

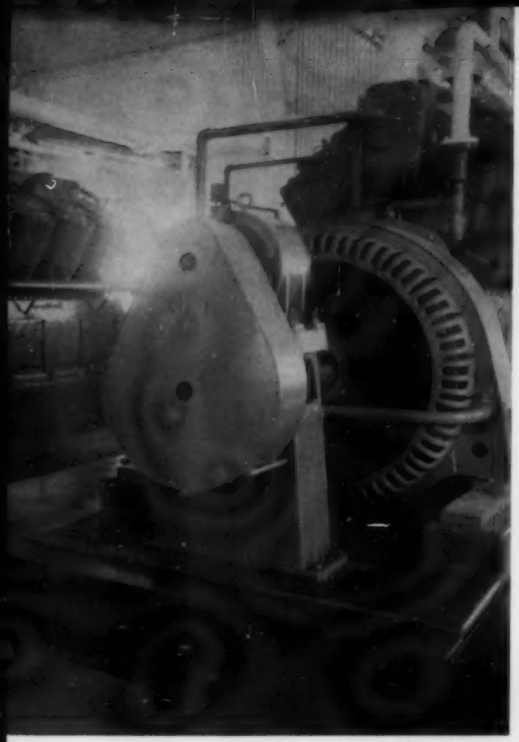
The plant was designed for an initial volume of 100,000,000 cu. ft. of gas per day and for later expansion to 150,000,000 cu. ft. capacity, yielding initially more than 177,000 gal. of liquid products. Besides the direct thermal stripping process, some of the relatively new features included in the plant design are the utilization of an absorption oil presaturator unit, a fractionating-type lean oil still, and a hydraulic power recovery unit which utilizes the pressure letdown of the rich oil stream from the absorbers to the flash tank. Gas flows through the plant at transmission pipeline pressure, going first to a pair of parallel absorbers pressure ranged between 675 and 775 psig. Two parallel absorbers were employed to limit the thickness of the vessel shell steel required not only for initial flow but for the anticipated 50 percent increase in volume. The absorption oil picks up the liquid product—about 8 percent of the total volume—and the remaining dry gas then flows on to the gas pipeline.

Rich oil is dropped to a pressure of 250 psig between the absorbers and a cold flash tank to unload ethane and methane. To make use of this necessary pressure drop, the high pressure rich oil is passed through an Ingersoll-Rand hydraulic turbine which drives an I-R low-pressure lean oil pump at 3560 rpm. The I-R turbine recovers 200 hp—"free power" that otherwise would have been dissipated in a pressure reducing valve. The stabilizing facilities are designed to deethanize the rich oil to such a degree that propane produced from the depropanizer (the first fractionator) will produce specification commercial propane as an overhead product.

These two Ingersoll-Rand 6-SVG-2 gas engine-compressors raise ethane and methane to pipeline pressure of about 700 psig for return to the outgoing line. A third unit was added after this picture was taken.







Electricity for the plant is supplied by these three Ingersoll-Rand model PSVG 8-cylinder heavy-duty natural gas engines, each rated 544 hp at 514 rpm and each driving a 380 kw Elliott generator. A fourth unit was added after photograph was taken.

pressor unit combines a six-cylinder, four cycle natural gas engine, with bore and stroke of 11¾ in. x 12¾ in., with an Ingersoll-Rand compressor with 12½ in. x 26 in., and 26 x 12 in. compressor cylinders. Three services are combined on each unit: still re-compressor, excess fuel booster and absorber recycle.

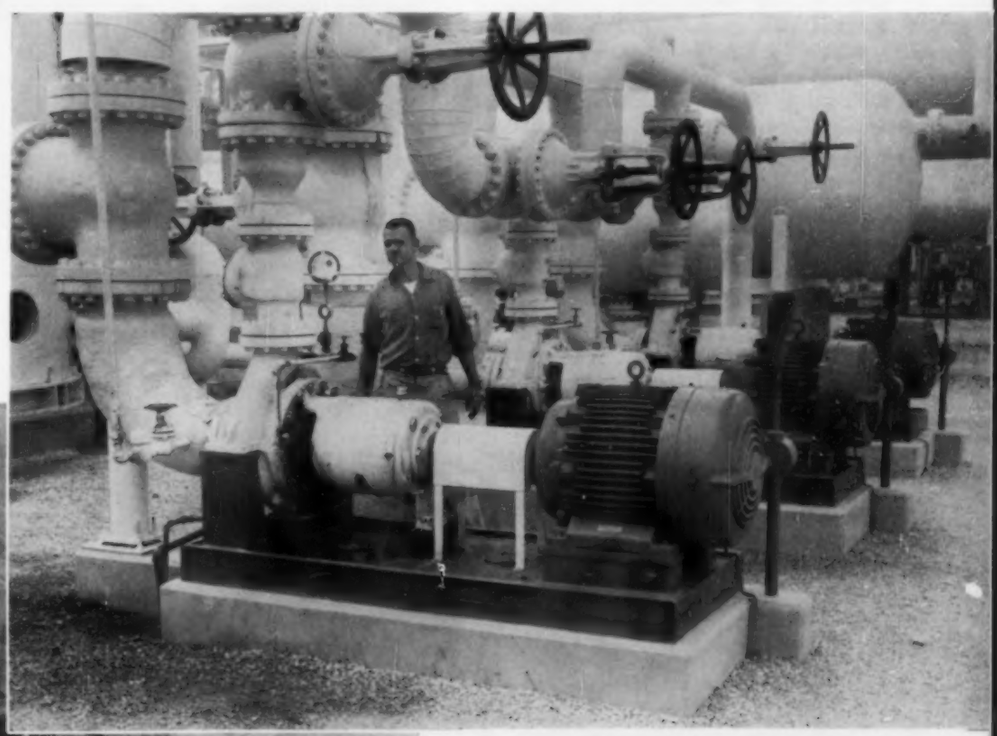
The product fractionation facilities include a depropanizer, debutanizer, and a de-isobutanizer to produce propane, isobutane, normal butane, and natural gasoline. Reboiler and preheater units provide a means for transferring heat to specific process streams from the hot lean oil stream leaving the base of the still. The lean oil is pumped from the still through the heat exchange units to a presaturator unit by a trio of I-R pumps driven by a 200 hp motor, a 125 hp motor and the hydraulic turbine. The oil is presaturated with propane recovered from the deethanizer and then, completing the cycle, is delivered to the twin absorbers at high pressure by a pair of Ingersoll-Rand 8-stage diffusor-type pumps. Each pump is driven by a I-R model PSVG 6-cylinder heavy-duty natural gas engine rated at 408 hp at 514 rpm. The PSVG engine is a unit incorporating the same basic four cycle, V-type construction as the SVG engine but without the compressor frames.

Most of the plant's pumps depend on electric power and the 33 I-R motor-driven pumps add up to a connected load of 1,216 hp. To supply this and other electrical requirements, the original plant was provided with three 8-cylinder Ingersoll-Rand PSVG-8 natural gas engines, each rated at 544 hp at 514 rpm and each driving a 380 kw, 480 volt, 3 phase, 60 cycle Elliott generator and 75 kw, 125 volt belt driven exciter. These facilities were soon augmented by a fourth engine-generator set.

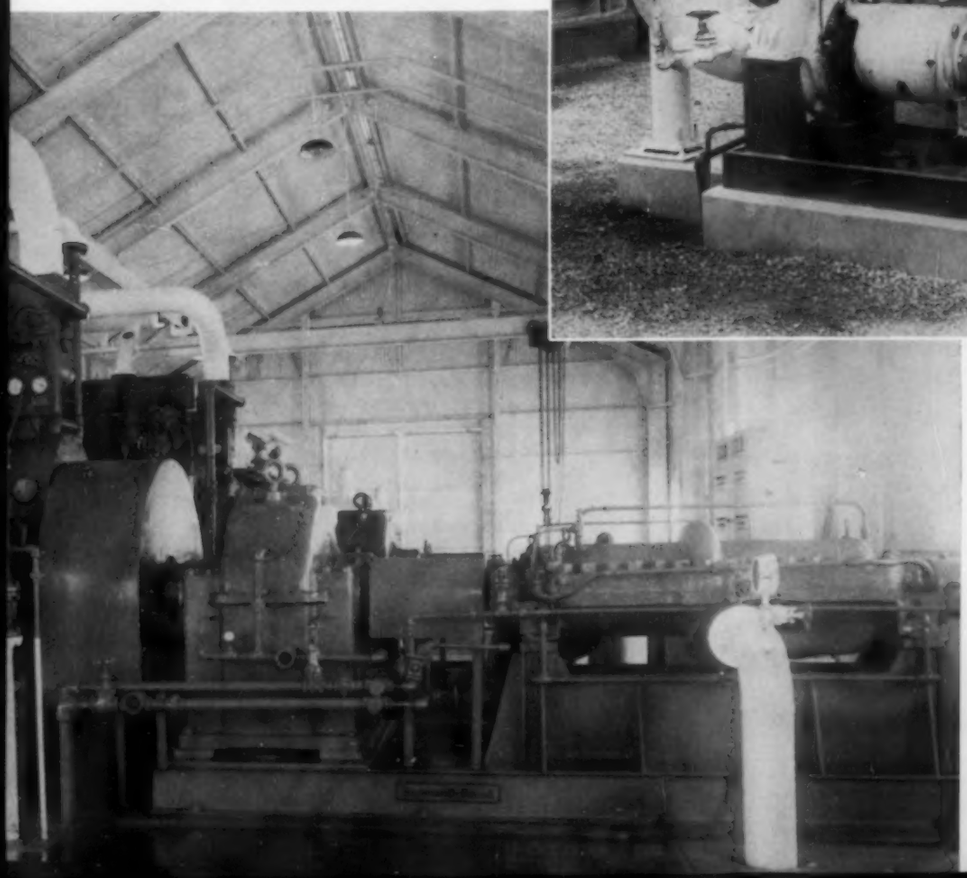
Pressure storage is provided for the four liquid products of the plant and tank car and tank truck loading facilities are located immediately adjacent to the plant proper. Availability of rail transport is an advantage not realized by many similar plants.

Ethane and methane in excess of fuel requirements are recompressed by Ingersoll-Rand gas engine compressors to 700 psig and dispatched to the outgoing pipeline. The original installation included two units, each incorporating an Ingersoll-Rand model 6-SVG-2, 330 hp, six cylinder V type gas engine driving three integrated horizontal compressor cylinders. A third engine-compressor unit has since been added to increase compressor capacity 50 percent. The 6-SVG-2 engine-com-

Two 408-hp I-R model PSVG-6 gas engines drive 8-stage diffusor-type pumps which deliver lean oil at high pressure from the presaturator unit to the absorbers.



Operator Mike Bement inspects the three Ingersoll-Rand rich oil deethanizer reboiler pumps, driven by 60 hp motors and rated at 2110 gpm at 1750 rpm.



This method of oil stripping is relatively new in the natural gasoline industry and is used in lieu of two other common stripping methods—thermal distillation aided by steam injection and distillation aided by light hydrocarbon injection. Elimination of steam dispenses with the boilers, cuts corrosion, and results in a cleaner absorption oil. Further, the new method provides high circulation off the base of the still without agitation.

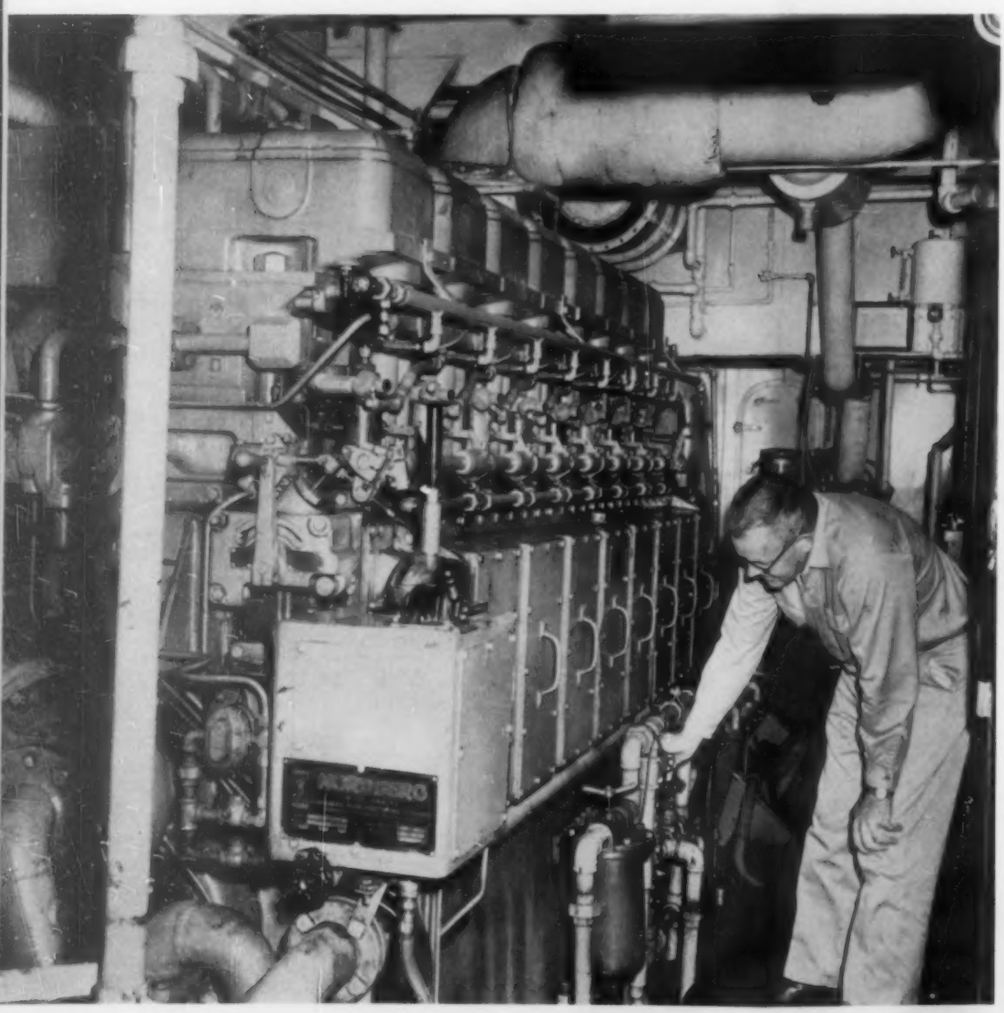
1280 HP BAY TUG MEETS SPECIAL DOCKING NEEDS

New Vessel Built for Standard of California to Cope With Tricky Currents in Rivers and Bay is Powered by Two Nordberg Turbocharged Diesels

DESIGNED, built and powered to achieve specific objectives set forth by the Standard Oil Co. of California, the trim 80 ft. tug, *Standard No. 4* handles petroleum barges and docks tankers in the San Francisco Bay area. L. C. Norgaard & Associates, San Francisco, designed her to meet these requirements; Colberg Boat Works, Stockton, built her accordingly and Nordberg powered her with twin 8 cylinder diesels that produce a total of 1280 shaft horsepower.

A tug was wanted that could (a) move a deadweight barge of 2662 long tons with a cargo of 25,740 barrels at 10½ knots, and (b) produce maximum thrust at zero speed in order to safely dock supertankers in the tricky, fast-running currents of San Francisco Bay. Because of the design and high power of this tug, the speed of the tug and integrated barge equals the speed of the tug running free. The use of Nordberg engines and Kort nozzles achieved the established goals. The owners were quickly convinced of this because the *Standard No. 4* almost immediately was thrown into night-and-day operation assisting in the transportation of Standard Oil products up the rivers and around the Bay and docking and undocking tank ships.

The new towboat is 80 ft. in length, has a 26 ft. beam, and draws 7½ ft. at the stern, fully loaded. Her displacement, loaded, is 234.5 tons. A noticeable feature is the towering wheelhouse. This height is desirable because she is essentially a pusher-type towboat and the pilot needs to see over the bow of the 260 ft. barge ahead.



The Nordberg model FS98SC main engines are heavy-duty, 4 cycle, 8 cylinder turbocharged units with 9 in. bore and 11½ in. stroke, each rated conservatively at 640 shp at 720 rpm. They drive through Falk model 7MB reverse-reduction gears with 2.87:1 ratio, turning the propellers at 250 rpm. The Coolidge wheels are mounted in Kort nozzles. They are four bladed, 72 in. in diameter, and with 54 in. pitch. The engine is controlled from the pilot house by a Westinghouse Air Brake control system.

Four fuel oil tanks have a total capacity of 13,694 gals. Engine-driven pumps take suction from the tanks and pass the fuel through duplex filters to the engine header. Engine air is drawn through filters on the inlet sides of the Elliott turbochargers. Both of the engines are equipped with Kittell spark-arresting mufflers.

The engine cooling system is of the closed type using a shell and tube type heat exchanger. Engine-driven centrifugal sea water pumps take suction from the high and low strainers and discharge into the lube oil cooler, thence to the jacket water cooler and overboard. A by-pass on this line provides for sea water cooling for both the oil coolers on the Falk marine gear and the Elliott turbocharger. A second engine-driven centrifugal pump provides jacket water circulation through the engines and

New tug is powered by twin Nordberg 4-cycle, 8-cylinder diesels, each rated 640 shp at 720 rpm. Fuel injection pumps are Bendix-Scintilla.

List of Principal Equipment

Main engines (2)	Nordberg
Reverse-reduction gears	Falk
Turbochargers	Elliott
Propellers	Coolidge
Governors	Woodward
Engine controls	Westinghouse Air Brake
Alarms	Brown
Pyrometer	Alnor
Temperature controls	Amot
Exhaust mufflers	Kittell
Air compressors (3)	Quincy
Fuel oil filters	Nugent
Jacket water cooler	Ross
Lube oil cooler	Ross
Lube oil and air filter	Air Maze
Lube oil pump	Viking
Oil strainer	Purolator
By-pass lube filter	Winslow
Fuel transfer pump	Blackmer
Fuel injection pumps	Bendix-Scintilla
Auxiliary generator sets (2)	Caterpillar

This new San Francisco Bay tug, *Standard No. 4*, is 80 ft. long, 26 ft. in beam, with 7½ ft. draft. Her high wheelhouse enables pilot to see ahead of 260 ft. barges which usually are pushed.

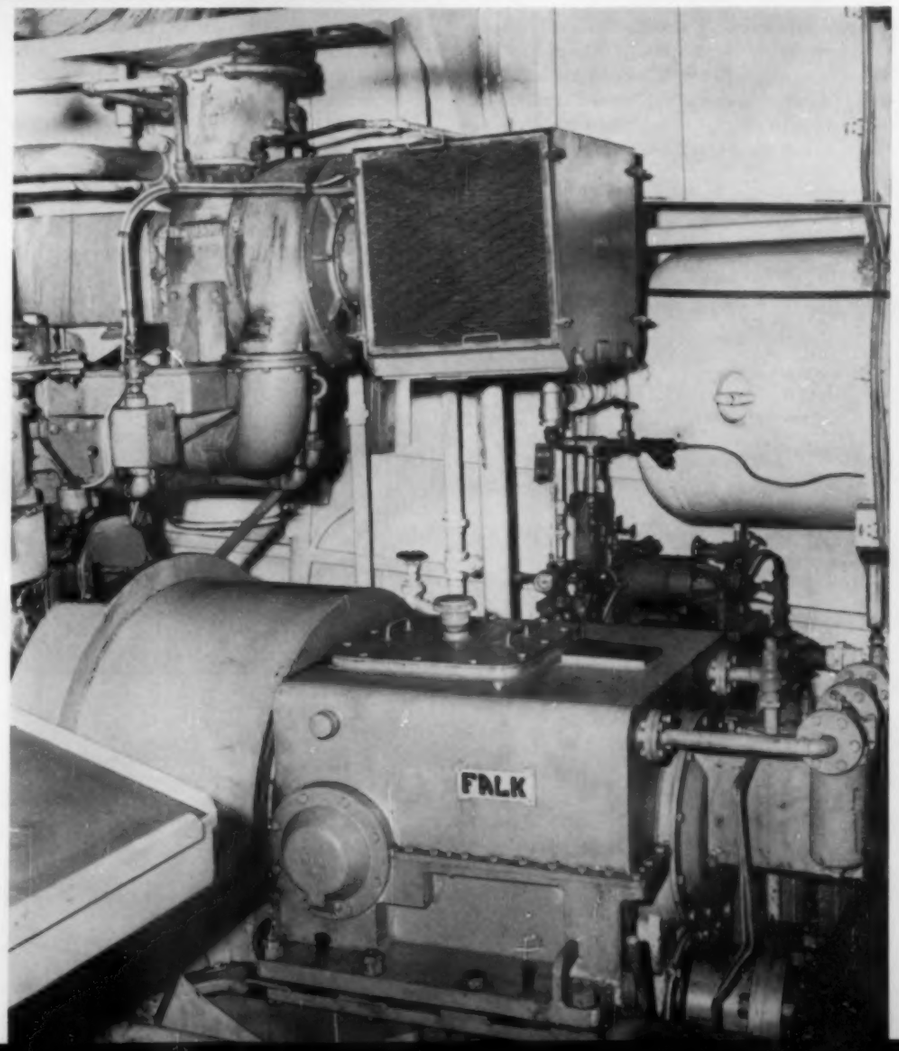
Falk reverse-reduction gear and Elliott turbocharger with Air Maze air filter on the Nordberg starboard engine. One of two air tanks and the fire pump are in background.

the jacket water heat exchanger with flow controlled by the thermostatic valve. There are two lube oil tanks, each with a capacity of 100 gallons. A pump takes suction from the engine base, passes the oil through a fullflow filter, a by-pass filter, and through the cooler with its thermostatic valve. Before returning to the engine, the lube oil is passed through a strainer.

Auxiliary power is furnished by two Caterpillar diesels, mounted aft of the main engines and between the shafts. Each turns a 40 kw, 240 volt, 60 cycle, 3 phase generator. Each also has a 40 hp front power take-off. One of the engines also drives one of the three Quincy air compressors on the ship. The other two compressors are motor-driven.

A ladder from the main deck leads into the forward part of the engine room, between the propulsion engines. The gauge board is erected above the foot of this ladder so it can be read from the doorway on the main deck. The main switchboard and one air compressor are located under the ladder.

Based at the Standard Oil refinery docks at Richmond, California, the tug's normal and primary runs are up the San Joaquin river to Stockton, and up the Sacramento River to the state capital, Sacramento. On occasion, the *Standard No. 4* also has been kept busy towing aviation fuel barges to the San Francisco International Airport in order to keep the new jets and other airliners operating on schedule. The new tug has responded well to the unusual demands placed on her services. She has the power, speed, and easy-handling characteristics which make her especially suited to her work.



DIESELS PUT "HUSTLE" IN MICHIGAN ROAD PROJECT

By J. W. BROWN

THROUGH almost unbelievably colorful scarlet, beige and golden leaves tumbling from maples, beech and poplars along the roadside, we drove across Michigan in late October to investigate a story of diesel progress along the western reaches of U. S. 16. This is the important highway leading N. W. by W. from Detroit straight across Michigan, through the state capitol city of Lansing and through Grand Rapids to Muskegon. Connecting with important north-south routes along the way, and, on the shores of Lake Michigan with ferry services to Milwaukee, it is one of three main border-to-border highways in Michigan and is being rebuilt and redesignated as Interstate Highway 96 and 196.

In keeping with the national trend, and with Federal aid, the Michigan State Highway Department has been making a step-by-step conversion of this previously overcrowded 3-lane highway into a 4-lane divided freeway. About half the distance between Grand Rapids and Detroit has been improved in this way. West of Grand Rapids only about 18 mi. of 4 lane highway has yet to be built to close the gap in the direction of Muskegon.

I started out to run down a materials-handling and trucking story involving the loading, hauling and stockpiling of 180,000 tons of gravel sub-base for the paving of this stretch and wound up with a "bonus" tale of the dieselization of an asphalt plant involving four diesels of three different makes used to power the plant, plus three other diesels in the equipment used to load it.

The contract for furnishing the 180,000 tons of gravel and stockpiling it along the route of the new highway was let to Paul C. Miller of Sparta, Mich. who also holds contracts for several miles of 4-lane, divided, bituminous paving on the upper part of the new highway. Other paving contracts on the road have been let to McLean and D. J. McQuestion Construction Companies of Lansing, Mich. to S. J. Groves and Son, Minneapolis, Minn.

We noted that there are abundant supplies of sand in the area which, of course, is needed both for fill and as part of the aggregate used in bituminous paving. But for the huge amounts of sub-base gravel and crushed stone required, it was necessary to go about 20 mi. to the east and draw upon the resources of the Grand Valley Sand and Gravel Co. and of two gravel pits operated by Mr. Miller.

Caterpillar D315 generator set which serves as a "standby" generator for the Miller asphalt plant, and furnishes lighting at night.

A trucking firm—the Clarence Yenglin Trucking Company of Pigeon, Mich.—accomplished the transfer of the 180,000 tons of sub-base material from the pits to three stockpiles along the route of the new U. S. 16 in jig time. To do the job Mr. Yenglin used twelve Mack and Autocar diesel tractors, all powered by Cummins engines. Each Yenglin tractor pulled a large dumping type semi-trailer and a trailer of Trailmobile, Freuhauf or Graham make. Some of these tractor-trains were rated at 42 tons capacity and some at 36 tons. About 80 loads a day were handled (approximately 2,640 tons) and *all* of the loading was done with one machine—a Hough H-90 Payloader powered with a Cummins diesel engine.

"Loading out" the huge piles of aggregates was the responsibility of the Paul Miller company. With the rubber-tired, high-reaching, fast Hough loader, the truck trains were made ready to travel with a full load in either seven or eight passes of the loader bucket, depending on the capacity of the trailers. When sandy conditions in the gravel pit made starting the loaded trains rough on the tractors, Miller's H-90 operator would circle

Hough H-90 Payloader loads one of the Yenglin Trucking Company truck-trailer trains for a 20-mile run with a load of sub-base gravel.

Loading operations at the Miller asphalt plant include the Lima dragline with GM Diesel engine, a "Cat" D6 and the "Cat" D8 just visible beyond the hopper.

his machine around and give the trains a push to get them on their way.

On the other end of the haul, the Yenglin Trucking Co. also used a Hough H-90 to level and compact the stockpiles of gravel which were eventually built up to a height of 15 ft. or more. As the truck trains would charge up to the top and unload their gravel, the H-90 shuttled back and forth spreading and compacting the gravel. Mr. Yenglin had purchased the Hough with an angling back-filler blade to be used as a 'dozer.

When we started out for a first-hand view of this operation we were surprised to find a Paul Miller portable asphalt plant on the job and already turning out hot-mix paving materials like crazy. I found Mr. Miller adjusting the plant's "Millermatic" automatic weighing and cycling controls which he himself designed. Mr. Miller's plant is a Madsen plant, completely portable and now completely diesel in operation. We retired from the blast noise of the dryer (which even drowns out the exhaust noise of three diesels which were then in operation) and went into the comparative quiet of his office trailer where Mr. Miller filled me in on the details.

The Miller asphalt plant can turn out from 750 to 1000 tons of bituminous mix a day. It is powered by two International diesels mounted in a big van-type trailer, and by a 4-71 GM diesel which drives the dryer fan. In the trailer an IH UD-18 diesel is belt-connected directly to the asphalt plant, and an IH UD-24 diesel drives a 440 volt, 100 kw generator to furnish power for conveyor drives, pumps, etc. Through a step-down transformer, this generator set also furnishes 12 volt power for the weighing and cycling controls. A Caterpillar D315 generator, parked beside the main power trailer serves as a "standby" and furnishes electricity to light the plant at night. The total dieselization of Mr. Miller's plant results in a degree of mobility that is highly prized in these days of fast-moving paving jobs. "Just last week" said Mr. Miller, "This plant was working up near Harbor Beach, Mich." Harbor Beach is about 225 miles from its present location.

The Millermatic weighing and cycling controls must turn out a product which is fully satis-

As soon as a Yenglin diesel truck dumps its load the Hough Payloader with angling dozer blade spreads and compacts it on the stockpile. Watching the operation is Clarence Yenglin, owner of Yenglin Trucking Co.

Incidentally, the Paul C. Miller Co. put down a 6-mi. stretch of this type of paving near Muskegon in 1958 as a test highway for the State. The success of this paving (on which Mr. Miller says they beat the 1/8 in. grade variation limit by 50 per cent) has lead the Michigan State Highway Department to plan for 190 mi. of bituminous concrete on main highways, Mr. Miller said.

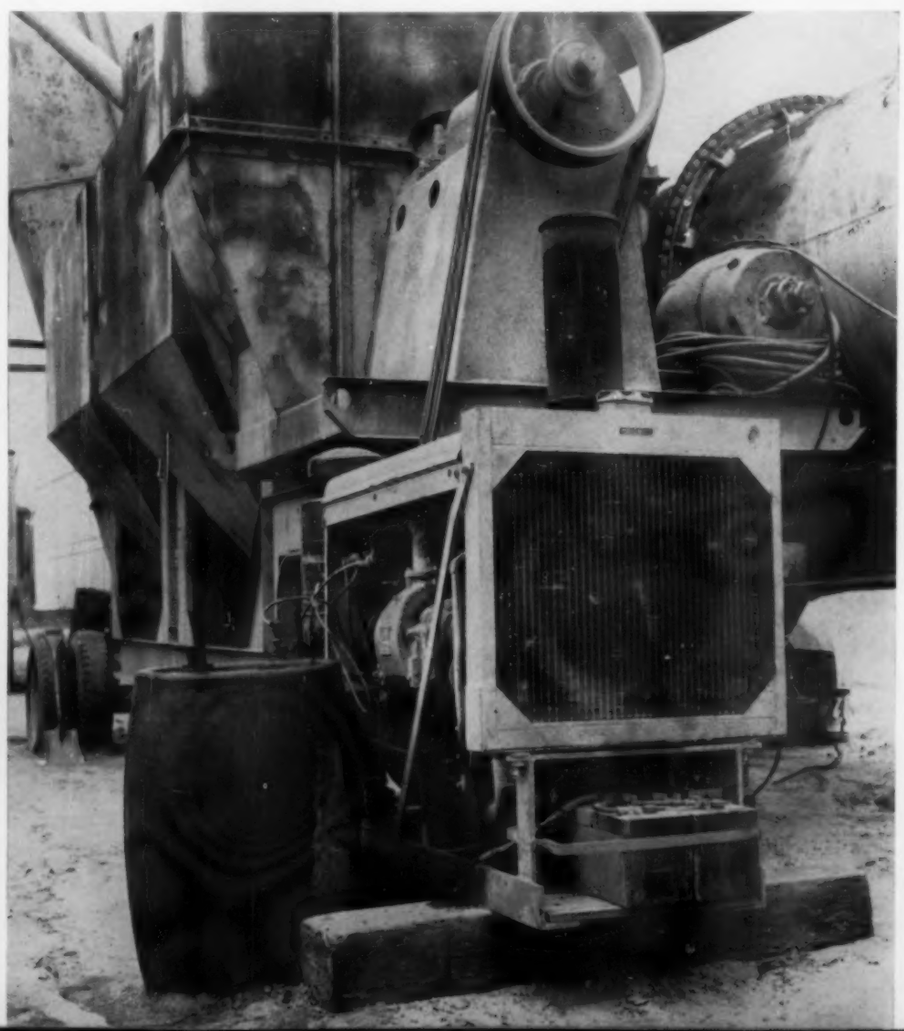
I had noted that the Miller asphalt plant's hopper was being fed by a Lima Model 34, 3/4-yard Paymaster powered with a 4-71 GM Diesel engine, and that two Caterpillar tractors, a D6 and a D8, were pushing sand and gravel up the stockpile slopes toward the Lima. On the way back from the paving operation we passed two more Caterpillar tractors fitted with specially built gravel spreaders and I asked Mr. Miller how much diesel equipment entered into his operation.

"You know," he replied, "I never thought to add it up, but we've got quite a bit. At our two gravel pits we have diesel on each of our crushers; an IH UD-18 on one and an Allis-Chalmers on another. We also have two Northwest shovels which are powered by a GM diesel and a Murphy. Some day I'm going to sit down and make a list of all of it." "Okay, that's fine," I told him. "And when you do, give me a copy of your list for DIESEL AND GAS ENGINE PROGRESS."

factory to the Michigan State Highway Department, since the latter exercises continuous inspection and control over the paving materials and methods being used. In fact, Mr. Miller is very proud of the results being achieved. He took me over a 2-mile stretch of the road being constructed, and pointed out that only a 1/8 in. grade variation in 10 ft. is permitted in the finished surface. It takes painstaking care to prepare the base for such a road, including the use of a land-leveling machine of 60 ft. span.

The asphalt paving being laid by Mr. Miller's crew is of the multiple-layer type. First a carefully graded, gravel-surfaced base is given a "primer" coat of asphalt. Then three successive layers of hot mix are spread, using in this instance a Barber-Greene paving machine. Each layer consists of crushed stone, sand and liquid asphalt in closely controlled proportions. By the time the second layer is down, the road must conform to a 1/4 in. in 10 ft. variation limit; the last course can vary only as much as 1/8 in. in 10 ft. according to Mr. Miller.

This GM 4-71 diesel engine drives the dryer fan on the Miller asphalt plant.



Paul C. Miller of Sparta, Michigan, a pioneer in multiple-layer bituminous paving in Michigan and a hearty believer in dieselization.

BETHANY'S PLANNING BRINGS RETURNS

While Area Waits for Natural Gas to Become Available, Nordberg Duafuel 2460 HP Engine Burns Fuel Oil to Trim Plant's Average KWH Cost to 6.04 Mills

WHILE waiting for natural gas to become available a new Nordberg Duafuel diesel in the Bethany, Missouri, municipal power plant is operating as an oil-burning diesel and establishing new standards of efficiency and economy for the plant. In its first nine months of service, the new unit has produced better than 14 kilowatt-hours per gallon of fuel consumed though operating with a load that averaged just 60 per cent.

Bethany's 1959 summer peak load was 1700 kw, up some 8 per cent from the previous year. Nearly all the electric load is for residential and retail store service. No heavy industrial load is present though there is some grain processing and cheese manufacture. At present the Bethany plant has four diesel engine-generator units; a 600 hp unit installed in 1929, a 1000 hp unit installed in 1946 and a 1600 hp unit installed in 1948. The new 2460 hp Nordberg replaced an old, low horsepower engine.

The latest addition, the Nordberg Supairthermal Duafuel engine, is a 12 cylinder, 4 cycle V-type, Model FSG-1312-HSC. This engine provides 2,460 hp, 1,750 kw at 450 rpm at an altitude of 915 feet. Though designed for dual fuel operation it is currently operated on diesel fuel only. Normal operating procedure is to buy off-peak power during the 11 p.m. to 6 a.m. period with all the diesels off the line. The diesels generate all the power required to meet the load during the main portion of the day.

The new engine went into service in November, 1958, and took over as base load producer. In the first nine months of operation, the engine was on the line for a total of 2,650 hours and generated 2,856,000 kwh while consuming 202,920 gal. of fuel oil. This represents an average of 14.06 kwh per gal. of fuel. In the 10 months preceding installation of the new unit, the plant average was 12.39 kwh per gal. In its first nine months of service, the new engine produced 65 per cent of total plant output and managed to raise the plant average to 13.55 kwh per gal. of fuel.

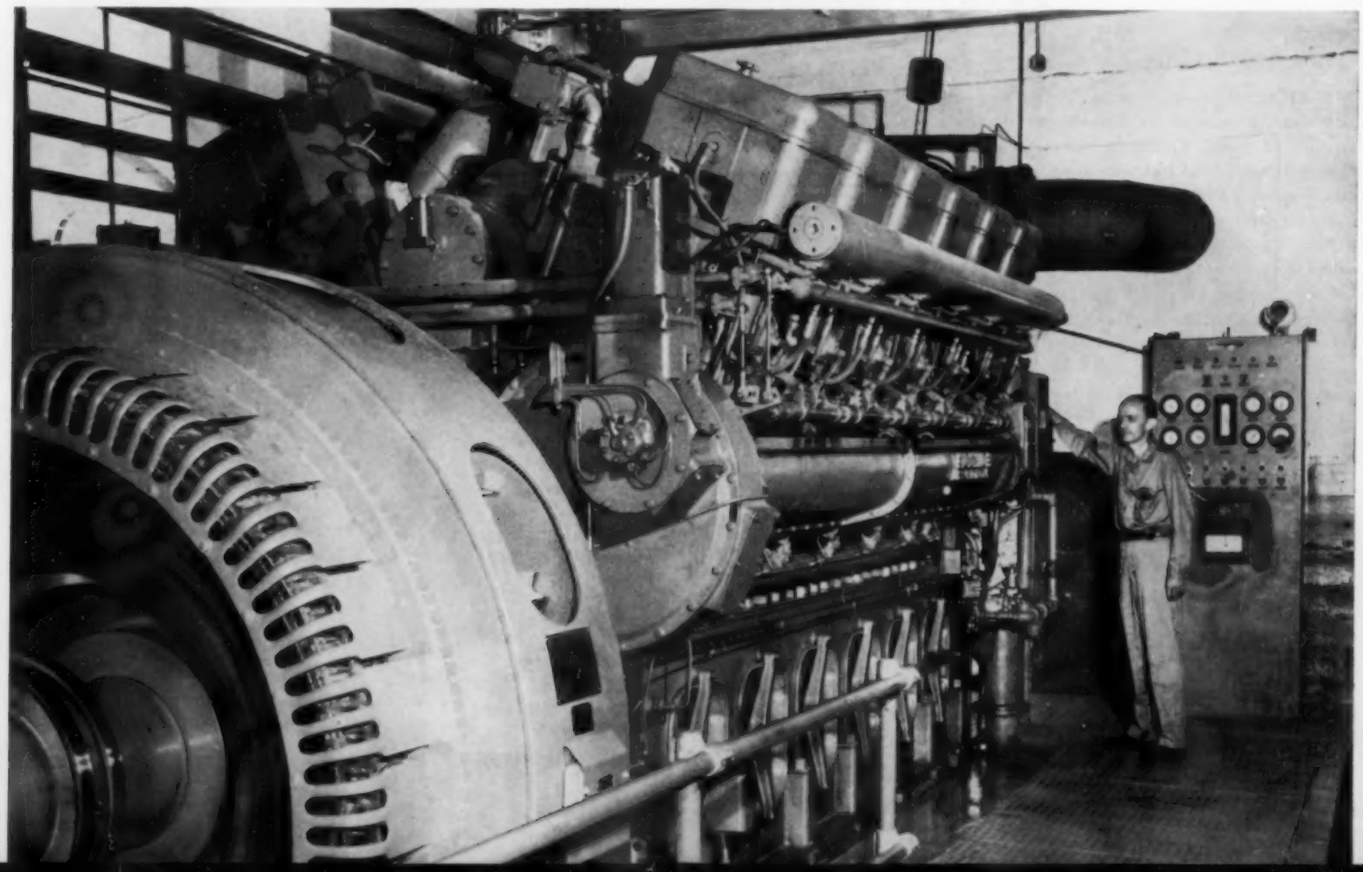
In the nine months, fuel cost for the big unit was 6.04 mills per kwh compared to the plant's previous average of 6.86 mills. With the Nordberg in service, plant average was down to 6.27 mills which meant a direct saving of more than $2,500. Savings should show a marked increase as the average load on the engine increases in the future.

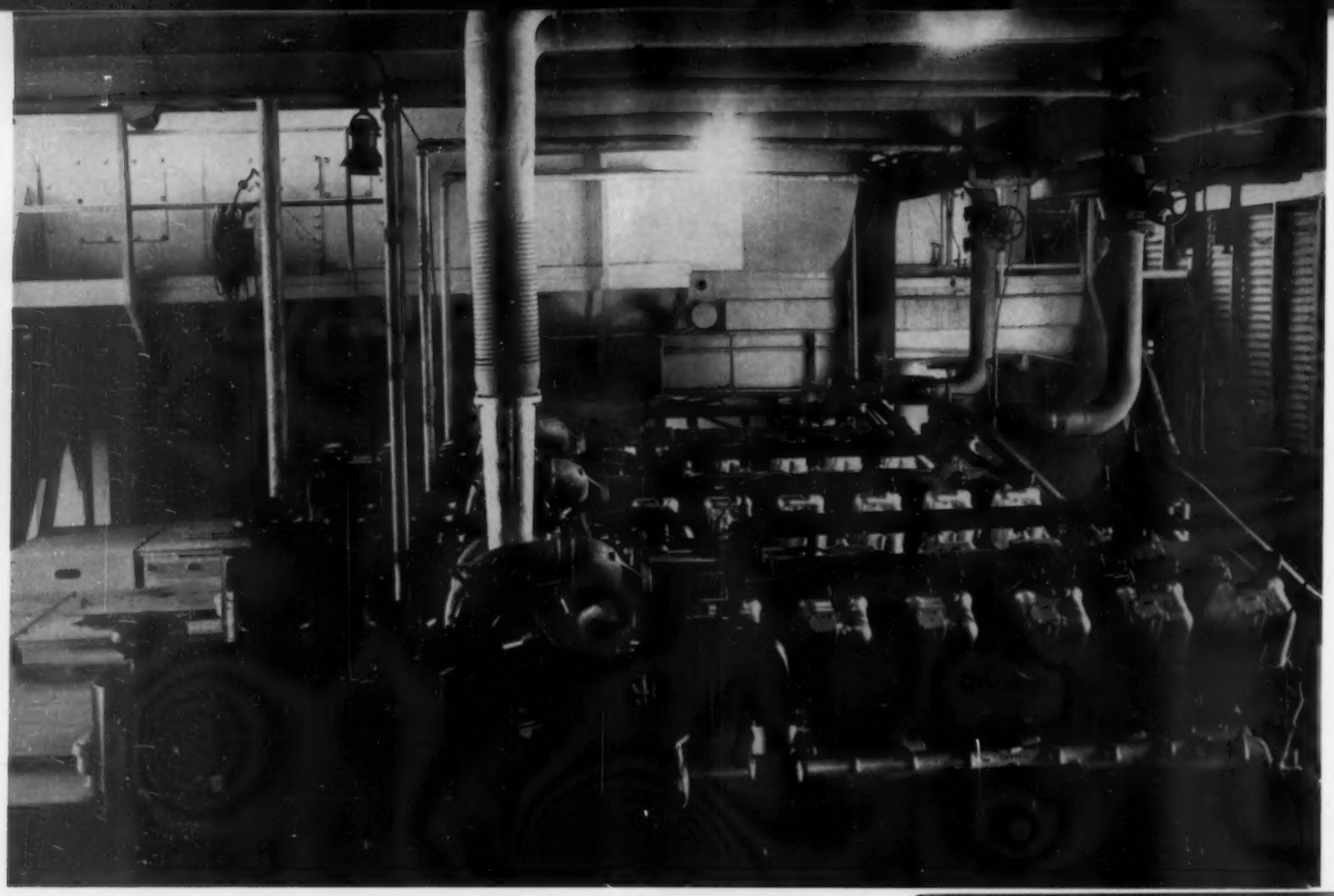
With this engine either oil or natural gas fuel can be used separately or in any combination as desired. All of the gas equipment has been installed with the engine and needs only a connection to the natural gas service main. Standard Special fuel oil is delivered to the plant at a current cost of 8.5 cents per gallon. Four outdoor storage tanks of 12,000 to 15,000 gal. capacity are available. The oil is metered and strained as it is pumped to the 600 gal. day tanks and is further purified with a micronic fuel oil filter before being injected into the engine cylinders.

Principal Equipment

Engine	Nordberg
Alternator and exciter	General Electric
Turbocharger	Elliott
Intercooler & aftercooler	Young
Governor	Woodward
Injectors	Bendix
Fuel filter	Purolator
Fuel meter	Neptune
Air cleaner	American Air Filter
Lube oil filter	Hoffman Allen
Pyrometer	Alnor
Lube oil	Mobile
Lube oil cooler	Ross

Kenneth Danford, superintendent of utilities, at the controls of the 2460 hp Nordberg Supairthermal engine. Engine drives General Electric 1750 kw alternator with 17 kw exciter. Note Woodward governor.





TIDELANDS BARGE FOR FIVE MILE DRILLING

By ELTON STERRETT

DRILLING crews, seeking deep-seated oil and/or natural gas beneath the tidelands marshes of South Louisiana, work their shift, then get time to rest and recuperate before again taking up their strenuous tasks. The diesels powering their drilling rigs, on the other hand, deliver 24 hour output, seven days a week, "resting" only when the crew reaches the pay zone or contract limit and the technique of well completion imposes a brief shut-down period while the casing cement sets or the hole is abandoned. One such rig is the Sharp Gulf Drilling Co.'s drilling barge *The Texas* at present stationed in a specially dredged canal and basin near Cote Blanche Bay, on the Gulf of Mexico. This barge is equipped with three 12 cylinder VLRDBSU Waukesha diesels for main power source, two WAKDU 6 cylinder Waukesha diesel Enginators (unitized and direct-connected diesels and ac generators) and one D337 Caterpillar diesel engine.

The barge is constructed on, or rather *over* a former car ferry float which was designed and built to take the strain of loading freight cars on its deck and thus had enough structural strength for the severe service encountered in barge drilling. The original deck was raised five feet to allow setting the unit on bottom in 14 ft. of water, and bulkheads erected along the sides to protect the machinery and crew from wave action should the drilling location be in open water. A second deck was divided amidships to provide crew quarters, galley and operations office at one end; the other serving as drilling floor, which was specially reinforced to carry the weight of the drilling machinery and up to 25,000 ft. of 4½ in. drill pipe.

The hull incorporates buoyancy chambers, which are filled with water so the barge rests steady on the bottom when drilling operations are under way. The barge was built by Russell Wolfe, of Harvey, La.; equipment and power unit supply and installation was under the supervision of Bethlehem Steel Co., Supply Division, working with engineers of the Sharp Gulf Drilling Co.

The three big Waukesha diesels are installed along one side of the power deck, with the two Enginators extending the row to five. Power is delivered to the Bethlehem B-1640 mud pump, or divide type 295-100 National torque-converters, which can concentrate the entire horsepower (2400 con-

Looking across the heads of the three Waukesha VLRDBSU turbocharged diesels which comprise the main power plant. The Elliott turbochargers draw air from the Vortox air cleaners, three for each bank of six cylinders, left.

tinuous, 3000 intermittent) to the drawworks or to the Bethlehem B-1640 mud pump, or divide the load to meet the widely varying operating conditions in drilling and completing a well.

The drive to both drawworks and mud pumps is through quadruple, oil cooled, silent chains. All controls and shifts are made by compressed air, as is the starting of the diesels. A Gardner-Denver two-stage compressor is V-belt driven from the outboard end of each engine. The engines are equipped with thermostatic controls at the front end. Twin circulating pumps, one for each bank of six cylinders, recirculate water in the jackets until the desired operating temperature is reached. Cooling above this point is provided by a dual system, the flow being divided between one 8x12 ft. Ross heat exchanger and the keel cooling system developed for barge rigs. Separate heat exchangers are provided to cool engine and torque converter oils, circulating coolant water through motor-driven 1x1½ in. Peerless centrifugals.

The two Enginators—Waukesha diesels direct-connected to 100-kw ac generators—provide 400, 220 and 110 volt electric power for auxiliary equipment, including circulating pumps, lighting, air-conditioning, and for the all-electric galley.

The B-1640 mud pump incorporates forged steel fluid ends, and requires a 3½-inch piston rod. With the three diesels coupled through the compound to the pump, it requires 2000 hp at 90 strokes per minute. On two engines it will absorb 1460 hp at 68 strokes per minute. With one engine driving it through the torque converter and the corresponding section of the compound drive, it is capable of putting up 4750 psi for high pressure work with small liners in the fluid end, when operated at 20 strokes per minute. A second mud pump, a Bethlehem GI-600, requiring 800 hp, serves as a standby. For mud-mixing, an operation which might be carried on when the main diesels are otherwise employed or shut down, a D337 Caterpillar diesel is installed on the pump deck and drives a Bethlehem H-25, 7½x14 pump. All three pumps are suction-fed by motor driven centrifugal pumps powered from the two auxiliary engine-generator sets. Normally, one set will carry the electrical load, leaving the second as stand-by. Connections are provided for twinning the two outputs should demand require.

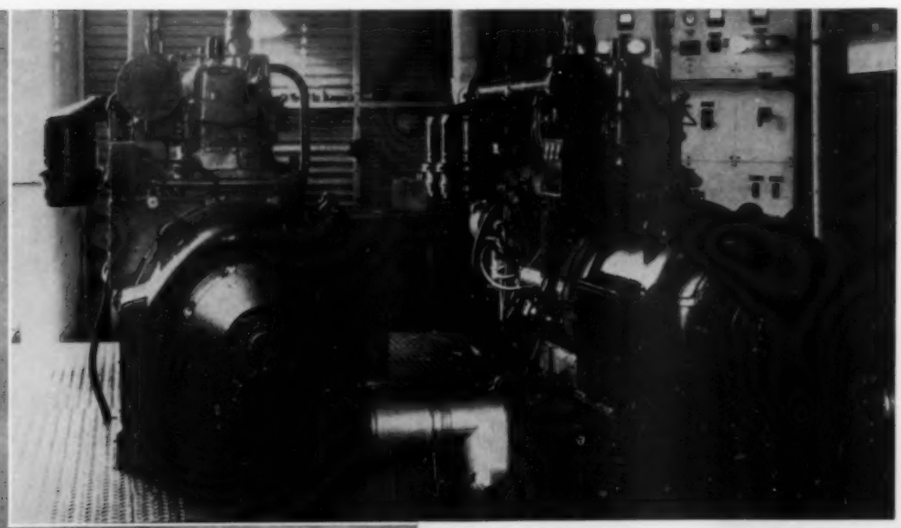
Use of the three 800 hp turbocharged diesels for prime power, combined with the giant mud pump, enable the drilling company to use 5 in. drill pipe and to make hole at such a rate that it is possible—in the Louisiana area in which the *Texas* is operating—to work in an open hole until the total depth for setting casing is reached. With 5 in. drill pipe, and the big pump delivering 760 gpm when operating with 7½ in. liners, the combination delivers the fluid under high pressure at the bit; thus effecting better bit cooling, more expeditious cuttings removal, and—to aid in "washing hole," approximately 600 hydraulic horsepower at the working face, in a 12,000 ft. hole when using 12 lb. mud.

Through the compound, the three diesels may have their 3000 intermittent horsepower concentrated on the task of hoisting the drill pipe out of the hole. With the three diesels on the Bethlehem B-3661 drawworks, it is possible to drill to a depth of 25,000 ft. (nearly five miles) when using 4½ in. drill pipe. For this service a 1½ in. rotary line is required, over a crown block rated at 700 tons, and through a traveling block rated for 600 tons. Total design capacity of the 140-ft. derrick on the barge is 1,100,000 lbs.

The well on which the drilling rig was working at the time the accompanying photographs were taken is the Williams, Inc. No. 2, in the Garden City Field, St. Mary Parish. Drilling was carried to 15,628 ft., and 9⅝ in. casing set to 14,000 ft. (the total weight of this string was approximately 660,000 lbs.); 7-inch liner was run to 14,901 ft.; and the 5 in. liner for completion was set at 15,624 ft. The well is one of the number in that field belonging to Quintana Petroleum Corp., Houston.

Principal Equipment

Main engines (3)	Waukesha
Generator sets (2)	Waukesha
Mud-mix engine	Caterpillar
Turbochargers	Elliott
Air cleaners	Vortox
Governors	Woodward
Pyrometers	Alnor
Lube oil filters	Winslow
Silencers	Maxim
Heat exchangers	Ross



Two Waukesha model WAKDU Enginators provide auxiliary power. Rated at 100 kw, each unit can carry the entire electrical load of the barge.

The Texas drilling rig sitting on the bottom in a dredged basin in a Louisiana marsh. The 140 ft. derrick and ample power enable this rig to drill to any desired depth up to five miles.

Front end of main power plant showing Winslow lube oil filters, cooling water pumps and, behind nearest filter, belt drive to nearest Gardner-Denver compressor.

WHIP LAKE PROBLEM TO REOPEN NEW ZEALAND MINE

Water Removed From Behind Levee by Pumping, Then Earthmoving Equipment Goes to Work To Expose Coal Veins Which Lie 60-180 Feet Below The Lake Bed

AT Kimihia, Huntly, New Zealand a coal mining operation is underway today that is unique. Coal is being won from under a lake bed but by open cast methods. Here's the story.

For 30 years, up to 1912, coal was extracted from a seam 60-180 ft. below the bed of Lake Kimihia, a shallow sheet of water about 12 ft. deep. In this underground operation, about three-fourths of the coal was left to provide natural pillars to support the mine. The "Taupiri Reserve Mine" as it was named was closed down in 1912 for economic reasons. The mine was abandoned for 30 years until 1942 when World War II prompted its reopening to help relieve a growing shortage of coal.

But underground mining techniques were not feasible. Instead, a levee or stop-bank was formed and the captive water was removed by pumping. When the dewatering was completed, the mine was attacked from the surface; a huge dragline first employed in spoil removal.

One of the major problems here was silt removal which was a time consuming proposition. In 1954, Downer and Company, Ltd. contractor handling the stripping job for the New Zealand Government Mines Department, added four Allis-Chalmers TS-300 motor scrapers and a pair of A-C HD-21 crawler tractors to help in the stripping work. The scrapers were employed to remove about a 20 ft. layer of fine clay or sedimentary mudstone directly above the coal seam. The mine is currently producing about one ton of coal per minute necessitating, for practical reasons, removal of ten tons of overburden per minute. Because of this, Downer has built up an imposing fleet of equipment to handle the needs of this job. Today ten Allis Chalmers T360 tractors, with big capacity movall rear dump wagons, a number of HD-21 crawler tractors and HD-6G and HD-9G tractor shovels are helping Downer keep pace.

An interesting contrast is revealed when old coal faces are exposed by today's modern machines. The walls, bearing marks of miners' picks, are floodlighted as scrapers open the old workings where no light has penetrated since the last miners' lamp flickered out nearly a half century ago.

The T360 tractors and their companion rear dump wagons make continuous treks from the mine site, loaded by a Bucyrus-Erie ¾ yd. power shovel, to the dumping pit where overburden is casted and wasted. Coal is extracted by means of a ¾ yd. shovel and conveyed by belt conveyors. An HD-6G, located in the vein, assists in the coal handling and muck removal to keep output at about 500 tons per shift. It's a colorful spectacle.

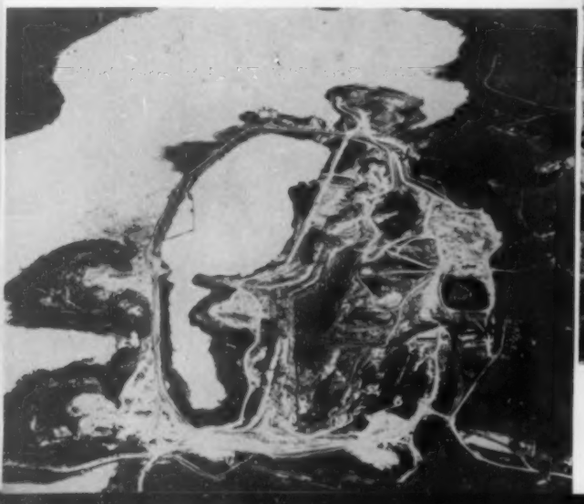
New Area Is Enclosed

About two years ago, another portion of the lake was enclosed by a 1⅓ mi. levee to surround an area containing 2¾ million tons of coal. This will extend the productive life of the mine as much as another 25 years.

After the stop-bank was installed, a cutter suction dredge, with Mirrlees 200 and 500 hp diesel engines was assembled on the shores of the lake and floated into position within the man-made embankment. The dredge went into operation in May of 1958; the cutter-propeller churning into the soft clays and silt at the bottom of the lake and expelling these materials in suspension with water through a jointed-floating pipe. It will require about five years to suck this enclosed body of water dry. This silt and soft clay removal will eliminate the problem of working these hard-to-

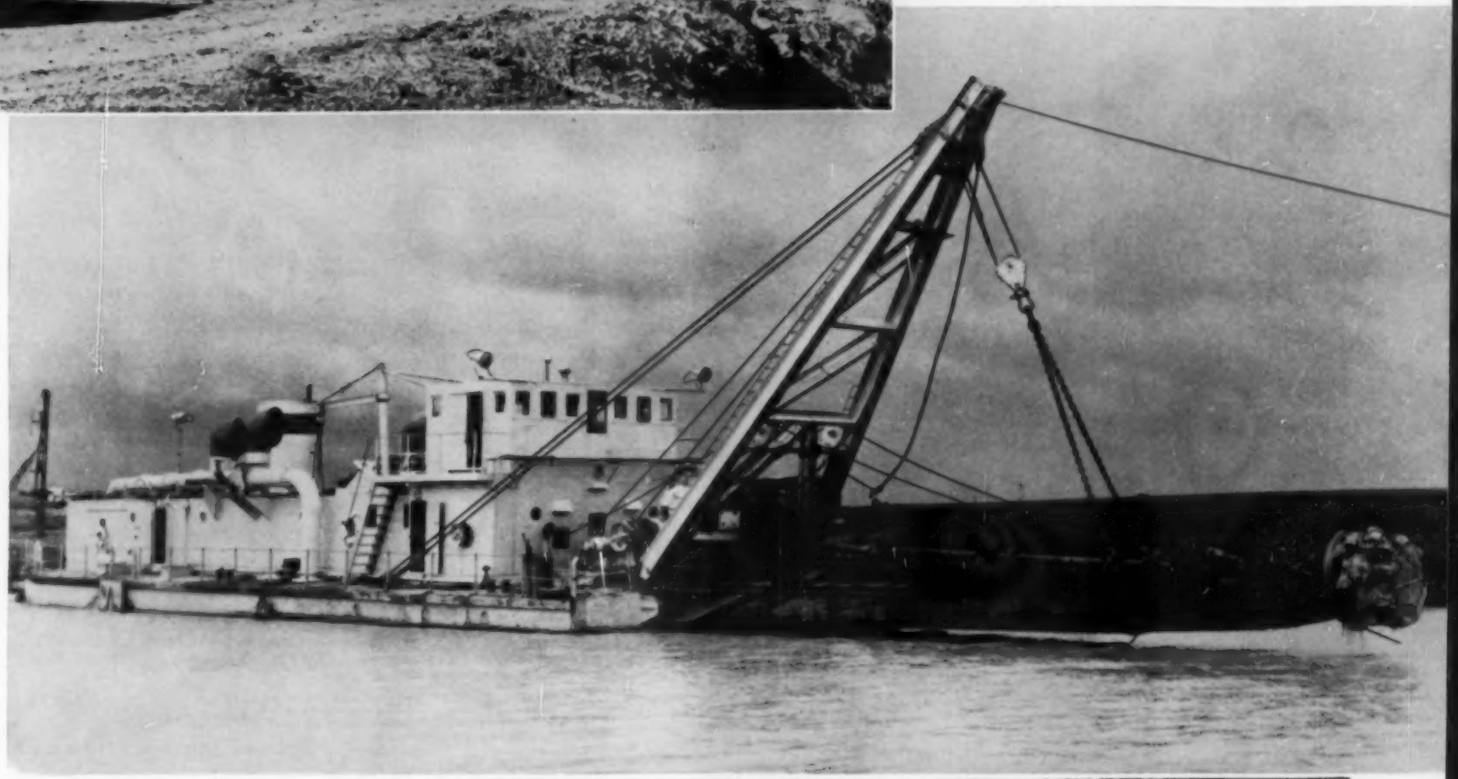
A fleet of ten T360 tractor equipped rear dump wagons are continually on the move from mine to dumping site to keep overburden removal humping at about ten tons per minute.

Aerial view of Lake Kimihia and the Kimihia coal mine. Note enclosed or diked-in area. Cutter-suction barge is currently discharging slit and water from the enclosed lake through a jointed pipeline. Area of present mining activity is at right of diked section



Three rear dump wagons, powered by Allis-Chalmers T360 tractors are loaded with overburden at the Kimihia Mine site by a Bucyrus-Erie ¾ yd. shovel

This 90 foot cutter-suction dredge is being used to dewater and desilt the newly enclosed section of Lake Kimihia to provide access to overburden above a rich coal seam. When the area is dryed-up, approximately 23 million tons of overburden must be removed to reach the underlying coal seam. Dredge is powered by Mirrlees 200 and 500 hp diesel engines.



handle materials when the area is dewatered. As noted earlier, this was a material handling problem with the first attempt at opening the mine up from the surface.

Allis-Chalmers International distributor product dealer serving this job, is Cable-Price Corporation Ltd. of Wellington, New Zealand.

Unit	Engine*	HP
TS-360 motor scraper	TDS-844	280
HD-21 crawler tractor	TDS-844 troque convert.	225
HD-6G tractor shovel	D-344	72
HD-9G tractor shovel	GM	100
TS-300 motor scraper	TDS-844	280
HD-16G tractor shovel	16000 torque converter	150

*All engines are Allis-Chalmers except where noted.

Old coal pillars, used to support the underground mine when it was worked nearly a half century ago, are exposed and reveal the early miners' pick marks

DESIGN AND APPLICATION OF PISTON RINGS FOR LARGE ENGINES

Here is Part One of a Paper Presented at The ASME Oil & Gas Power Division Kansas City Meeting That Defines Current Piston Ring Technology as Applied to Medium and Low Speed Diesel and Gas Engines

By FRED A. ROBBINS and JOHN W. LIPPERT*

ADVANCEMENTS in the sciences of metallurgy, metals processing, and machining, coupled with the ever-broadening use of gas and diesel engines, have resulted in a continuous advancement with respect to any parameter in which one might choose to define engines; including output on the basis of displacement, weight, fuel cost, operating cost, and so on.

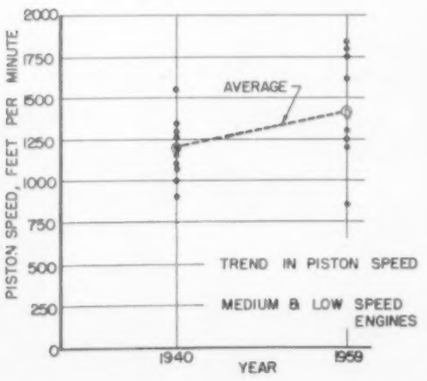
In order to meet the market requirements, which are based on the fundamental economics of initial cost, operating cost, and maintenance cost, there have been some specific trends in engine design:

1. Higher piston speeds
2. Higher mean effective pressures
3. Utilization of turbo-charging
4. V-Engine Design
5. Improved thermal efficiency
6. Higher compression ratios

A comparison of representative engines marketed in 1940 and those available today, indicates the magnitude of change. Piston speed, Fig. 1, has increased for medium and slow-speed engines from an average of 1200 to 1420 fpm; an increase of 18 per cent. The increase in brake mean effective pressure, Fig. 2, is more striking; 4-cycle engines have increased from 76 to 175 bmep, or 131 per cent. Two-cycle engines have increased from 69 to 105 bmep, or 57 per cent. This increase is to a major extent due to the introduction of turbo-supercharging of engines. Data are based on the maximum speed and horsepower at which engines were advertised in 1940 and 1959.

*Respectively Manager, Sales and Engineering and Project Engineer, Piston Ring Department, Metal Products Division, Koppers Co.

Fig. 1. Trend in Piston Speed



Collectively, all these trends have introduced a marked effect on the requirements for piston rings, and there have been marked advancements in ring design, material, and application. In a broad sense, piston rings are made of stronger, more wear-resistant, and more stable materials. They are being produced with a much higher degree of precision, and in progressively more complex forms. They are being designed more specifically for the individual engines, and often for the particular type of service.

Effect of Piston Ring Performance On Engine Operation

An understanding of piston rings as applied to modern engines requires an understanding of the relationship of the rings to the engine conditions for which rings are applied. Piston rings have two basic purposes: (a) To seal the combustion gases in the combustion chamber; and (b) to meter lubricating oil as required to lubricate the piston and the rings themselves.

It is necessary that piston rings mate with the cylinder and establish a satisfactory bearing combination; this initial period of operation is called the break-in or run-in period. Note that this ability is not necessarily associated with long engine life. In fact, rings which will establish the longest operating life usually require more special care during the break-in period.

The first operating function of piston compression rings is to establish a satisfactory gas seal during the run-in period. The establishment of this gas seal demands that contact be maintained between the face of the rings and the cylinder wall; and the sides of the rings and the ring grooves. The establishment of such contact assumes (a) that the parts have sufficient precision as manufactured to be very close to having the surfaces matched; and (b) that the process of metal removal, to establish these precisely matched surfaces, occurs rapidly enough in operation so that no excessive blow-by results; but not so rapidly that it will cause destruction of the surfaces (1, 2).[1]

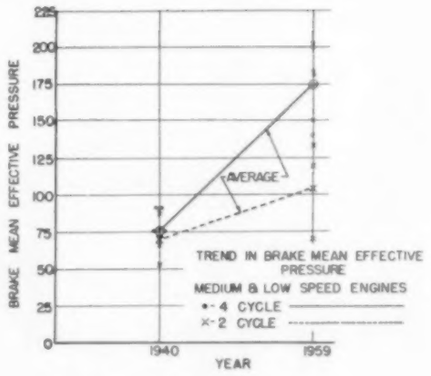


Fig. 2. Trend in Brake Mean Effective Pressure

Run-in scuffing is a common problem in internal-combustion engines; and refinements in ring, cylin-

[1]Numbers in parentheses designate References at the end of the paper.

Fig. 3. Typical Piston Ring Face Bearing Appearance

Well-Seated (Normal)

Severe Abrasive Wear

Severe Adhesive Wear (Scuffing)

Fig. 4. Properties of Statically Cast Piston Ring Materials

DESIGNATION	XL POT CAST ALLOYED GREY IRON	K-IRON GREY IRON AMS 7310	K-14 HEAT TREATED ALLOYED IRON	K-6E ALLOYED GREY IRON
MIN. TENSILE STRENGTH PSI	30,000	30,000	40,000	37,000
MIN. TRANSVERSE RUPTURE STRENGTH PSI	55,000	60,000	75,000	67,000
MEAN MODULUS OF ELASTICITY PSI	15,500,000	14,000,000	14,500,000	14,000,000
MIN. IMPACT STRENGTH IN-LBS. .140 x .260 UNNOTCHED BAR	9.0*	1.5	3.0	3.0
MEAN HARDNESS	201 BHN	80 R_g	29 R_c	245 BHN
MICROSTRUCTURE	GRAPHITE CONSISTS OF AFS-ASTM TYPE "A" SIZE 2-3. MATRIX CONSISTS OF MEDIUM TO FINE PEARLITE CONTAINING ISOLATED ISLANDS OF STEADITE.	FINE PEARLITIC MATRIX -- AFS-ASTM TYPE "A" SIZE 5-6 RANDOM FLAKE GRAPHITE	TEMPERED MARTENSITIC MATRIX GRAPHITE TYPE "A" FLAKE RANDOM OR ROSETTE FLAKE GRAPHITE	GRAPHITE CONSISTS OF AFS-ASTM TYPE "A" SIZE 4-6 RANDOMLY DISTRIBUTED FLAKES. MATRIX CONSISTS OF FINE PEARLITE CONTAINING RANDOMLY DISTRIBUTED ISLANDS OF STEADITE

* Min. Impact Strength - .210 x .390 in unnotched bar.

der, and piston design are required for virtually all new engines to prevent this phenomenon. This problem is more critical for engines rebuilt with worn parts, such as out-of-round cylinders and piston with worn ring grooves.

Smooth cylinder liners from previous operation may result in absence of essential mating wear with subsequent blow-by and destruction of lubrication. Worn ring grooves may result in high stresses in rings, and cause breakage or heavy wear. Engines rebuilt in the field often cannot be run-in on a gradually increased load, and speed schedule in the same manner as new engines are prepared for full output. An additional factor is the difficulty in maintaining control over parts rework, rebuild, and run-in practice.

It is essential that new engines also have good initial oil control. The high cost of modern lubricants, and the effects of burning excessive amounts of lubricating oil on deposits and operation, dictate that oil control be established almost immediately. Also, the low output economy of gas and diesel engines results in many engines being placed in service with virtually no full-load operation during much of their life. Oil control under these conditions is extremely critical inasmuch as combustion-chamber temperatures do not burn accumulated lubricating oil cleanly, if at all.

The single, most common reason for overhaul of internal-combustion engines is the failure of piston rings to perform their required function satisfactorily. The engine will identify its dissatisfaction in a number of ways; usually high oil consumption, heavy blow-by, or noise. A careful analysis is required to determine the manner in which the failure has actually occurred. In many cases, deterioration reaches such degree that the specific cause of failure cannot be identified. For example, an engine may be shut down for piston slap, and a cylinder may be found to be scored. The scoring may be a result of excessive blow-by due to stuck compression rings; due to excessive compression ring belt deposits; due to loss in oil control; due to wear of oil rings; due to excessive abrasives in the oil. Therefore, we can only identify the fundamental factors that may be associated with the limitations of satisfactory piston-ring performance. The actual resolution of individual engine problems is often impossible. A careful investigation of the behavior pattern of many engines of a family may be required to determine cause of performance limitation.

The principal cause for ring removal is "normal" wear. The term, "normal," requires definition inasmuch as the type of wear which is normal for a given engine is a function of its design, the types of fuels and lubricants used, and the type of service. Essentially, however, wear is necessarily of one of three types, or a combination thereof (3, 4). In most engines, varying degrees of combination almost always occur. These types of wear; abrasive, adhesive, and corrosive, are well defined in technical literature; there is voluminous experimental data defining wear types and the factors which control within certain limited conditions (5, 6, 7, 8). Fig. 3 illustrates (a) a well-seated, normal compression ring; (b) a ring subjected to severe abrasive wear; and (c) a scuffed ring, which characterizes severe adhesive wear. Rings subject to corrosive wear generally appear similar to a normal, well-seated, ring.

Unfortunately, no ring design or material will simultaneously give optimum protection against all three types of wear. The selection of materials and designs, therefore, becomes a compromise, taking into consideration the controlling variables of other mating parts, engine design, fuels and lubricants, and operating conditions.

Abrasive wear is a function of the amount and rate of admission of abrasive material either through the air intake, crankcase, or built into engines. Therefore, in a general sense, abrasive wear can be best combated by use of hard materials.

Though adhesive wear usually identifies itself as destructive scuffing, it may occur under borderline circumstances with nothing but rapid wear rates of parts (9, 10). Adhesive wear is basically controlled by the inherent scuff resistance of the materials as pairs. The optimum ring material in this respect is controlled by the cylinder material against which it must operate. A bench-test procedure, developed in our laboratory, has been used for many years as a general index of the scuff resistance of pairs of materials as well as a means for establishing the general relative wear rates of the materials (11). This test, however, is not infallible. For example, chromium plate produces a very unsatisfactory test under these conditions. It has proven of most value when used in comparing the various compositions of statically and centrifugally cast irons.

Corrosive wear results from chemical action of the products of combustion on the rubbing surfaces (12, 13, 14). Corrosive wear can be controlled by alloying, usually with nickel. However, sufficient quantities to substantially improve corrosive resistance, result in an adverse effect on scuff resistance. There is a need to develop new ring material with a combination of corrosion and adhesive wear resistance.

Breakage of piston rings is a significant factor in limiting life. This is, in general, related to the transverse rupture and impact strengths of the material employed. One of the principal reasons for the use of chrome-plated rings is to prevent breakage via application of a strong, tough base material, which in itself is not a good piston-ring bearing material.

With wear and progressively increased leakage of gases through ring joints, ring temperatures rise and oil contamination increases. Ring collapse may occur due to the increased temperatures. Ring-belt deposits due to carbonization of oil and deposition of fuel soot may increase, resulting in stuck rings and plugging of oil drain holes.

Ring plugging and sticking may be associated with the fuels and oil lubes applied, engine operating conditions, combustion cleanliness, and so on, rather than ring design (13, 14, 15). However, rings can be designed to minimize the effects of or control the causes of plugging and sticking.

This discussion has been introduced to identify the technological complexity surrounding piston-ring performance, and the evaluation thereof. While the technology of internal-combustion engines has become progressively more and more scientific, the tremendous number of variables involved in ring performance, and the limited ability to identify these variables, necessarily retains a major factor of art in this field.

Trends in Piston-Ring Materials

Piston-ring materials for gas and diesel engines are going through significant changes with the ad-

DESIGNATION	K-16 PEARLITIC DUCTILE	K-27 MARTENSITIC DUCTILE	K-28 HARDENED DUCTILE	K-26 HARDENED MALLEABLE
MIN. TENSILE STRENGTH PSI	90,000	120,000	120,000	95,000
MIN. TRANSVERSE RUPTURE STRENGTH PSI	135,000	165,000	180,000	130,000
MEAN MODULUS OF ELASTICITY PSI	23,000,000	23,000,000	24,000,000	22,000,000
MIN. IMPACT STRENGTH IN-LBS. .140 x .260 UNNOTCHED BAR	30	23	8	4
MEAN HARDNESS	27 R_c	27 R_c	43 R_c	43 R_c
MICROSTRUCTURE	FINE PEARLITIC MATRIX GRAPHITE OCCURS AS UNIFORMLY DISTRIBUTED SPHEROIDS	MATRIX OF TEMPERED MATRENSITE GRAPHITE OCCURS AS UNIFORMLY DISTRIBUTED SPHEROIDS	MATRIX OF TEMPERED MARTENSITE GRAPHITE OCCURS AS UNIFORMLY DISTRIBUTED SPHEROIDS	TEMPERED MARTENSITIC MATRIX GRAPHITE AS TEMPERED CARBON NODULES

Fig. 5. Properties of Centrifugally Cast Piston Ring Materials

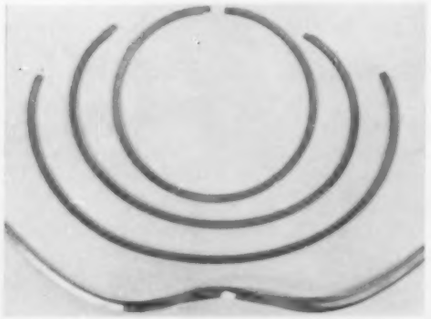
vancements in engine design and more stringent performance requirements. They have been developed to obtain the optimum in wear, breakage resistance, and processing ability. Early engines utilized unalloyed individually cast gray-iron rings as typified by XL and K-iron respectively, Fig. 4; these materials are still widely used in noncritical applications such as intermediate compression rings for medium and slow-speed engines. They have good scuff resistance, but have limited breakage, abrasive-wear, and corrosive-wear resistance.

There are distinct limitations as to the configurations which can be produced due to grain structure and strength of unalloyed gray iron. Low-alloyed gray irons, including 1 per cent or less of nickel, copper, manganese, molybdenum, or chromium, which may or may not have special heat-treatment, have been developed. K-14 and K-6E irons, as indicated in Fig. 4, are typical of such materials; K-14 is essentially a compression-ring material. Substantial improvement in physical properties can be noted. Heat stability is also substantially improved. The alloying results in changes in microstructure and a fine-grain structure. Because of the limitations inherent in cast-iron metallurgy, a balance between properties must be maintained. For example, increased tensile strength, through increasing alloys, or modifications of silicon or carbon content, could reduce both scuff resistance and impact properties. The net result of the material development, then is established as an iron that has excellent wear and scuff resistance, and meets the strength, heat stability, and machining requirements for rings for high-output diesel and gas engines. K-6E is essentially used as an oil-ring material, and has a very fine-grain structure for maintenance of sharp scraping edges.

Further improvement in properties is accomplished by resorting to centrifugal rather than static casting, and utilization of malleable or ductile irons, Fig. 5. While malleable iron has become widely accepted in high-speed diesel and aircraft engines, the section size of rings for large engines limits the applicability of the malleable irons. Ductile irons, however, do not suffer limitation as to section thickness, and are being applied to many of the more critical large-engine applications.

Pearlitic ductile iron, as typified by K-16, was first applied to large diesel and gas engines to overcome breakage problems which were found in some cases to occur even with high-strength malleable irons. The extent to which it is possible to distort a ring of this material without breakage is indicated in Fig. 6. Martensitic ductile iron, as typified by K-27 iron, is a more recent development, and has even better physical properties than K-16, except for a slight decrease in impact strength. Heat stability is also improved.

Fig. 6. Ability of Ductile Iron Ring to Withstand Distortion



Hardened martensitic malleable iron, as typified by K-26, Fig. 5, is widely used for high-strength rings for use in chromium-plated cylinders when the section size will permit. It has been proven to be more wear resistant than the unhardened malleable materials.

K-28, which is a hardened martensitic ductile iron (Rc40-46), was developed for use as an unplated ring material in chromium-plated cylinders where the section size of the ring exceeded the limits of K-26. It has, however, been performing very satisfactorily in unplated cylinders as a compression and oil-ring material on small-bore engines.

The life of poston rings is usually limited by wear. Applications of chromium plate is known to reduce substantially ring-wear rates by as much as five times. This plate is applied from 0.006 to 0.016 in. thick depending upon the requirements. For medium and slow-speed gas and diesel engines, the chromium plate is usually porous to a thickness of 0.001 in. to allow quick seating and good lubrication at run-in. The face of the ring may have one or more grooves applied to improve scuff resistance. For most engines and service, chromium plating of the top ring only results in adequate life of the ring set, inasmuch as the top compression ring usually experiences the most severe wear. An additional value of chromium plate is that it enables the use of a high-strength base material that cannot be applied bare due to limited scuff resistance.

For extremely severe service, it is possible to improve the wear and scuff resistance of even the best of cast-iron materials by interrupting the iron bearing face with a properly selected material. A band of phosphor bronze inserted in the bearing face is effective in this respect. Laboratory bench testing supports the advantage of the bronze insert in reducing wear (16). Multiple grooves in the face may be filled with one of several bearing or mild abrasive materials, such as powdered bronze, iron oxide, graphite, or molybdenum disulfide. Compression rings of this type are required for many modern 2-cycle engines.

Editor's Note: Part two of this paper, to be run next month will deal with design criteria of compression rings and oil control rings and typical piston and ring arrangements.

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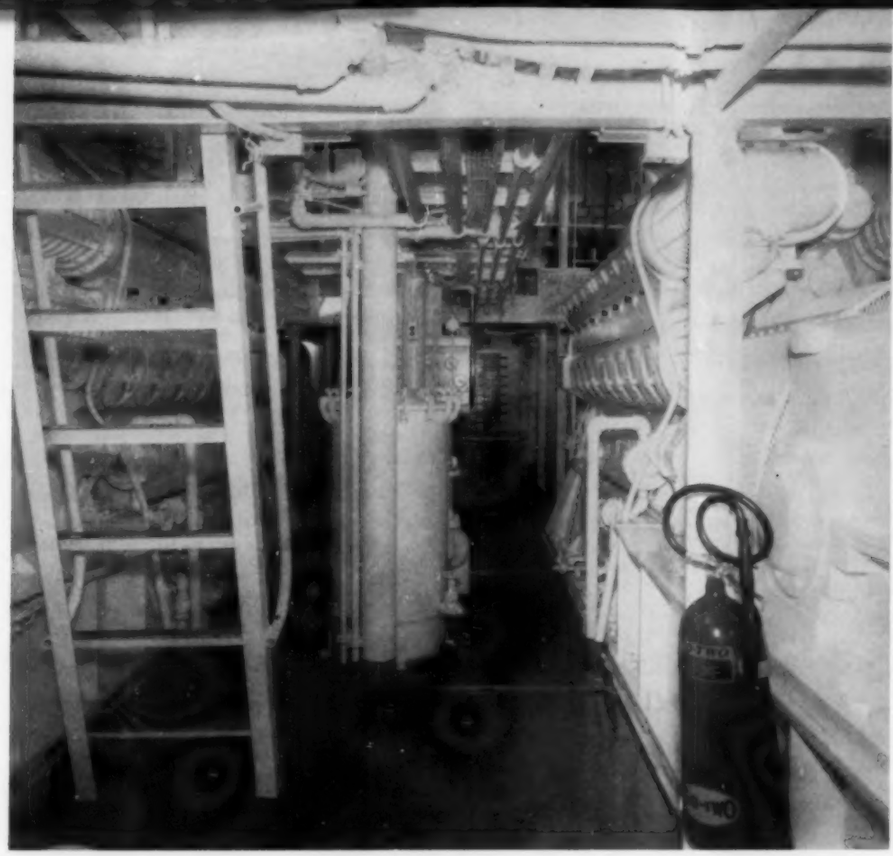


Lower engine room view, looking forward. Engines are GM 16-567C, rated 1640 hp at 800 rpm. Falk reverse-reduction gear and Airflex clutch are visible at right.

M/V JAYNE HOUGLAND

THE latest member of the growing family of towboats of the Hougland Barge Line, Inc., has gone into service after christening ceremonies recently at Paducah, Ky. The new towboat was named *M/V Jayne Hougland* after the vessel's sponsor. Designed and built by the Nashville Bridge Co., Nashville, Tenn., the 3200 hp towboat is 150 ft., 2½ in. long, has a molded length of 149 ft., beam of 35 ft., depth of 10 ft. 4½ in., and maximum draft of 8 ft. 6 in.

The *Hougland's* long, easy lines, spoon shaped bow, generously rounded bilge and propeller tunnels were designed to provide maximum flow of water to the Kort nozzles and propellers. During the past year, extensive tank tests were carried out at the Netherlands Shipbuilding Experiment Basin, Wageningen, Holland. By use of a large, self propelled model of the *Jayne Hougland* and a fleet of integrated barges run in the tank at various speeds and towing conditions, the most effective design for the nozzle, propellers and rudders was developed. As a result of this research, Nashville Bridge's naval architects predict the vessel will prove one of the most efficient vessels of her draft ever built.

The *Jayne Hougland* is powered by a pair of General Motors model 16-567C diesel engines matched for inboard rotation of the shafts. Each vee type engine with bore and stroke of 8½ x 10 in., is rated 1640 hp at 800 rpm. The engines are direct connected to Falk reverse reduction gears of 3.96:1 ratio with Airflex clutches and drive 102 in. dia. four bladed propellers.

Completely surrounding each propeller is a Kort nozzle, built by Nashville Bridge as a fully integrated portion of the hull. An interesting construction feature of the nozzle is incorporation of a 20 in. wide circle of ¾ in. stainless steel to insure absolute and uniform minimum propeller tip clearance and to prevent erosion. Stern tube and strut bearings are automatically lubricated through flexible hoses running through tunnels in the strut casting. Lube oil is scavenged and recirculated.

Shape, balance and location of the four flanking and two steering rudders were determined in the model basin tests in Holland and allow maximum flow of water through the nozzle and propellers while providing rapid positive flow under load conditions. Power for rudder control is provided by the Nashville Bridge Co., air steering systems—one for flanking rudders and another for steering rudders. This arrangement insures absolute rudder control even though electric power may be temporarily lost. The rudders run from hard over to hard over in 15 seconds at operating speed. Auxiliary electric power is provided by two diesel GM 6-110 diesel engines driving 100 kw generators at 1200 rpm to supply current for the 120/208, ac, three phase system.

The fuel oil system is supplied by ten wing tanks —five on either side of the boat. Two tanks are forward of the engine room, two tanks are on either side of the engine room and four aft of the engine room. Fuel oil can be transferred from any tank to any other as well as to the towing knee or midship fueling stations.

Principal Equipment
M/V Jayne Hougland

Main engines	GM (Cleveland)
Reverse reduction gears	Falk
Starting air compressors	Gardner-Denver
Lube oil pumps	Viking
Fuel oil filters	Briggs
Shaft bearings	SKF
Propellers	Coolidge
Auxiliary generator sets	GM (Detroit)

M/V Jayne Hougland. Vessel is in service on a regular run with integrated petroleum tows between Pittsburgh and Port Arthur, Tex.

SEE POWER COST SAVINGS IN USE OF GAS ENGINES FOR AIR CONDITIONING UNITS

When Used As Prime Movers for Driving Refrigeration Compressors, Units Can End "Demand" Charge; Versatility of Engine Speed Control Cuts Cycling Time, Increases Life of Air Conditioning Components

INSTALLATION of air conditioning in new construction today is as a matter of routine but a major cost problem of air conditioning lies in its rather seasonable use in nearly every section of the country. Electrically driven compressor systems with enough capacity to control temperatures in larger buildings require rather large prime movers to handle the compressors. So, although electric motors have had this field almost exclusively, the economics of power supply indicates a trend to other prime movers. Gas engines, although still holding only a small part of the field, are proving out as economical power sources for conditioning systems.

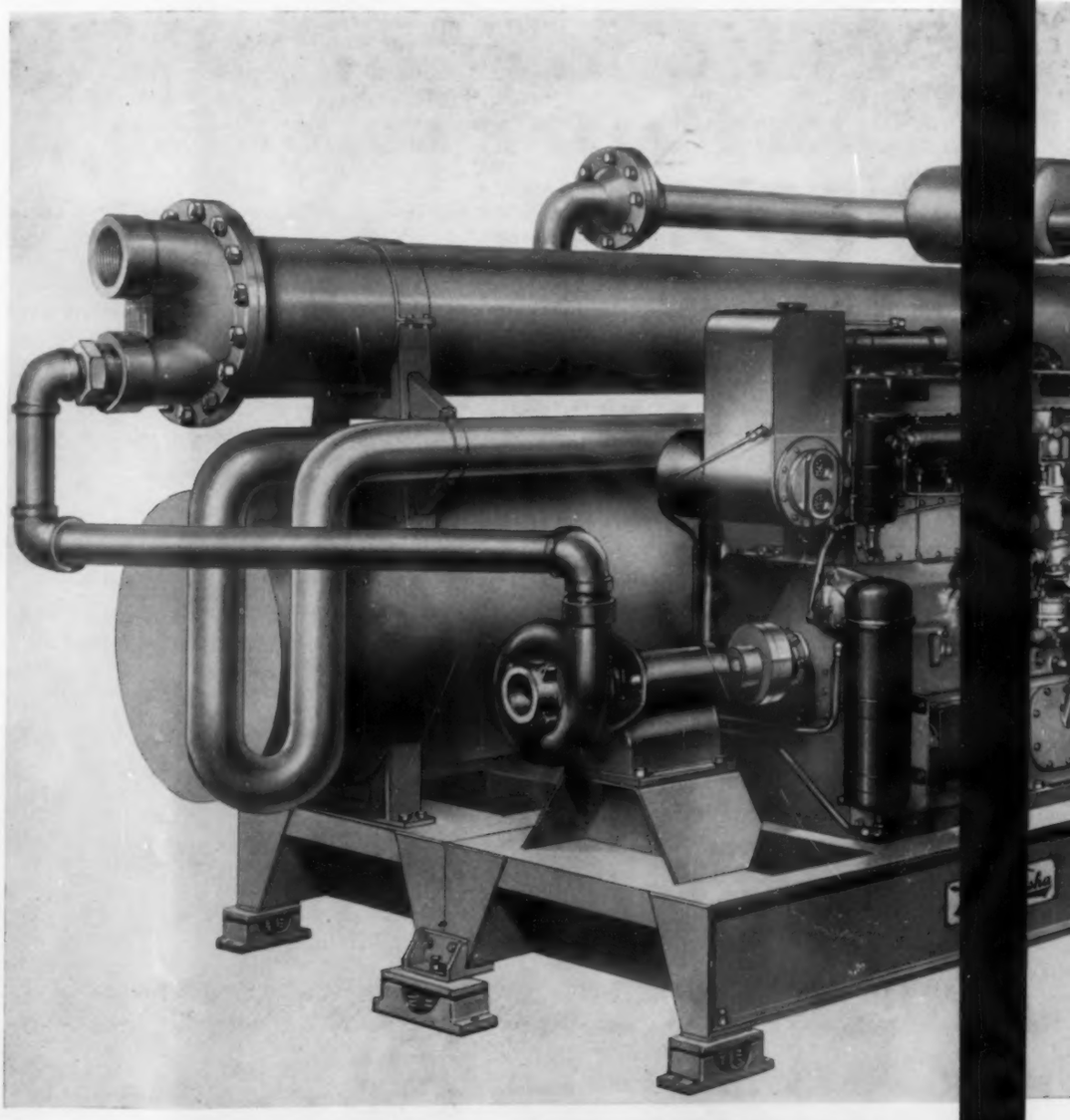
Here's how the dollar and cents aspect figures in: an electrically driven compressor system usually is installed on a demand-type contract with the electric utility. This contract requires, because of the size of the motor and extent of electrical lines and equipment to serve it, that the customer agree to pay for a certain amount of electricity whether it's used or not. And oftentimes the demand charge can equal or exceed the charge for power actually used. On the other hand, since the bulk of natural gas consumed is used in the colder months for heating, the gas engine system can receive the most advantageous rate for use in off-peak periods. And, of course, the off-peak periods for gas consumption are the very times when air conditioning units have the heaviest fuel demands.

Of course there are other than rate advantages to use of gas engines for air conditioning. An electric motor can run at only one speed. When the conditioning system's thermostat says the required temperature is reached the motor shuts down or the compressor partly "unloads." Then it cycles on and off and on again to meet rising and falling temperatures. This recycling is wearing on compressor, motor and every other moving part in the air conditioning system.

A gas engine, on the other hand, can be set to run at varying speeds to handle demand, yet allow more continuous operation, depending on temperature conditions. Also, as in an electric motor system, the compressor can be valved to allow "unloading" to maintain the required temperature level. Or, both varying speed and unloading can be used to minimize recycling.

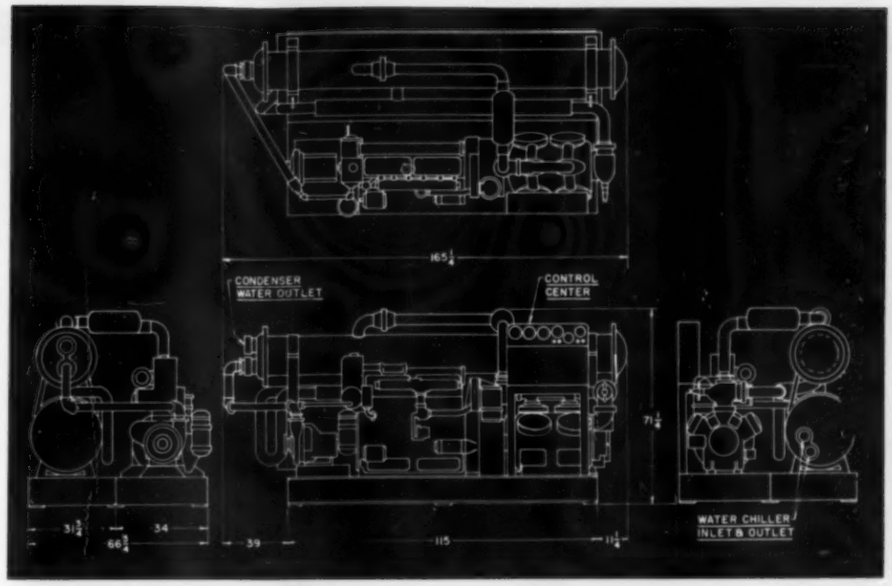
To see how gas engines are used in air conditioning applications let's look at a typical unit built by the Waukesha Motor Co. Waukesha has been producing engine driven air conditioning units for a number of years, including installations in major buildings in the Southwest and on railroad passenger cars for 45 major railroads.

A compression system air conditioning unit consists, normally, of the compressor, a prime mover to power the compressor, cooler and condensers. Refrigerant is compressed to high pressure in the compressor. This high pressure gas then



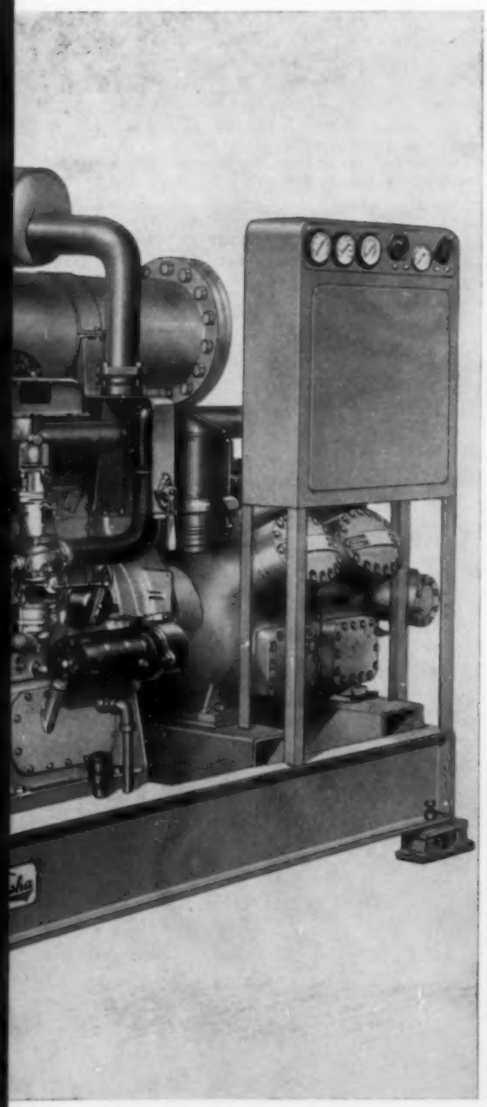
100 ton air conditioning water chiller unit built by Waukesha Motor Co. Prime mover is model 140-GZ gas engine which is coupled to 100 ton compressor at the rear, drives water pump at front. Large tank at left is the water chiller, smaller tank above is condenser. Small tank at top right is heat exchanger for engine cooling. Model 140-GZ engine is rated 144 bhp at 2000 rpm. Note Winslow lube oil filter. Above filter is special crankcase breather unit which extracts oil from crankcase fumes, then feeds fumes into intake manifold, oil into lube system.

Schematic installation diagram of 100 ton water chiller unit. Whole unit is mounted on two skids for convenient assembly, testing and transportation and installation.



flows to the condenser where air or water from the city water system or cooling tower passes through a coil and condenses the vapor to a liquid. The liquid refrigerant, its pressure reduced as it flows through an expansion valve, is passed to the chiller where the refrigerant evaporates and cools the water in the coil. Vaporized refrigerant from the chiller is returned to the condenser where the cycle is repeated. Water cooled in the chiller is circulated through coils in the heating or separate system and air flow over the radiators provides the cooling transfer.

Waukesha makes a wide range of natural gas engines which are used in air conditioning systems. The model discussed here is the 140-GZ, the power source for the company's recently announced 100 ton air conditioning water chiller unit, and it is typical of the range, which include models from 10 to 900 hp produced by the firm.



The 140-GZ is a 6 cylinder gas engine with bore and stroke of 4⅝ x 5½ in. for a displacement of 554 cu. in. The engine is rated 144 max. hp at 2000 rpm and develops 396 ft. lbs. of torque at 1000 rpm. It is equipped with Ensign natural gas carburetor and automatic choke.

The complete unit is skid mounted with the engine driving the compressor off the rear end of the crankshaft and a condenser water pump for the system from the front. Skid mounting allows the engine-compressor unit and the chiller-evaporator assembly to be assembled and tested at the factory as a unit, and, if necessary, torn down for easy, two piece transportation and installation at the building site.

The gas supply for the engine comes from the normal service line into the building. And, the engine uses standard 110 volt ac current for the specially designed ignition system and 110, 220 or 440 volts for the starting motor, thus no starting batteries or generators are needed.

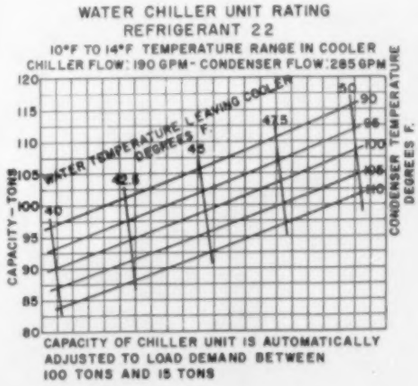
The air conditioning unit is fully automatic, with the engine starting on demand from the thermostat, varying speed and shutting down as required by temperature conditions in the building and monitored by the thermostat.

The thermostat, located in the chiller, is activated by temperature changes in the water circulating through the chiller. When the water gets warm or cool, the thermostat senses the change and relays this information to the engine control through a Minneapolis-Honeywell Modutrol unit which controls speed and fuel settings on the engine. This means the engine can run at any speed between 1200 and 1800 rpm, depending on the load demand on the refrigeration system.

When the load demand is so low that slowing engine speed (and "unloading" if the compressor is so designed), still produce cooling effect beyond demand the control system will shut down the engine until demand rises to the starting point again. When it reaches that point, the automatic restarting cycle is carried out. The unit is also equipped with provision for manual starting for testing. A fuel shutoff solenoid valve supplied with the engine makes a positive shutoff of the gas supply to the engine for safety purposes. The unit is also equipped with high water temperature and low oil pressure sensing devices for automatic shutdown if either of those conditions arise.

Engine cooling on the unit is by a heat exchanger mounted above the engine. Jacket water from the engine is passed through the shell and tube exchanger where it is cooled by water from the chiller system.

The engine has been designed to operate a minimum of 2000 hours without attention and several features contribute to the extended period. The electric ignition system mentioned above is of heavy duty components including special spark plugs to allow this extended service. The 40 gallon lube oil supply tank continually circulates the oil through a full flow filter to keep the level of contamination to a minimum, allowing long operation without change of lube oil or lube oil filter. The engine also has a closed crankcase breathing system to keep crankcase fumes from entering the engine room. This special device extracts oil from the crankcase fumes and feeds it back to the lube tank, passing the fumes into the intake manifold of the engine.



REBUILT SHELL DREDGE, *BROWARD II*

By ED DENNIS

THE *Broward II*, a giant dieselized dredge, gulps oyster shells along with sea water from Tampa's Bay bottom as it dredges and recovers sea shell aggregate for road building in Florida's West Coast Area. The *Broward II* is one of three dredges owned by the Benton Co. of St. Petersburg, Florida and the heart of the dredge is its diesel plants. All major machinery on the dredge draws its power from at least one of the three Superior diesel engines. Power for the dredge's 18 x 16 in. bore and stroke Maddox shell pump is provided by a model VDS Superior diesel engine rated 550 hp at 330 rpm.

Contractors have been digging and dredging for oyster shells in this large semi-tropical body of water for over 50 years and there is no sign of depletion of the supply. Oysters have been used as food and oyster shells as building material since the days of dim antiquity. Historians say these shell deposits were the spoils left by many thousands upon thousands of meals enjoyed by Florida's ancient Indians. Some of these beds have been here a million years and more. Florida came into being during the ice age when the sea rose and fell according to the whims of the earth's surface. During one of these polar cold periods, the State's shore line extended over 50 miles further west of the Tampa area.

A couple of years ago, the *Broward II*, dredged up some bones of a pre-historic animal some of which were over eight inches in diameter. The bones were sent to the University of Tampa for study purposes. Another time this dredge brought up some cypress knees that were 25 to 30 ft. below the top surface of the shell banks. The *Broward II* was originally built in 1925 in Baltimore, Md. Of the scow type construction, her hull measures 135 ft. by 40 ft. by eight ft. and until her conversion to a shell dredge 12 years ago, she was a conventional sand and mud dredge operating along the East Coast of the United States.

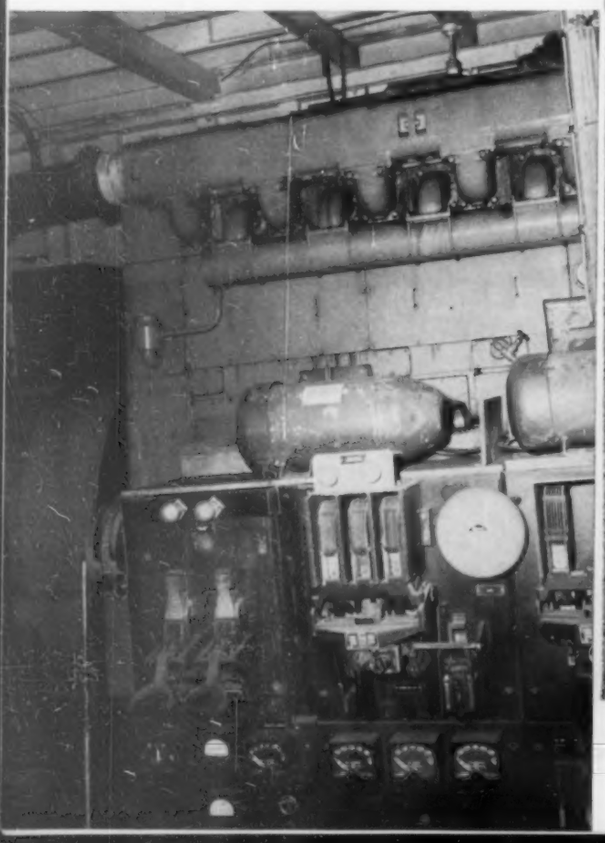
In 1959, the dredge was overhauled and refitted with ⅜ in. steel plating. Its beam was widened with the construction of four 5 ft. water-tight compartments on each side of the hull.

Among the reasons for modernizing this 34 year old dredge was the desire to increase its production and cut operating costs due to the stiff competition being given the oyster shell operators by the lime rock quarries in this vicinity plus the ever increasing demand for more road base material in the housing developments that are springing up over night.

The "A" frame is built of eight inch "I" beams cross braced and hangs on four one and one-half hog rods. The ladder is constructed of 22 in. x ¾ in. steel "I" beams, is 46 ft. high and has a basket type cutter head. The two spuds mounted aft are horizontal steel cylinders with a diameter of 26 inches and are made of ¾ in. steel with five foot points. The port or walking spud is 54 ft. long and the starboard or digging spud measures 59 ft. long. The starboard spud is lowered to the bay's bottom to act as a pivot on which the dredge swings back and forth. Two 1500 lb. swing anchors, one on each side, are also used in this phase.

The 135 x 40 x 8 ft. shell dredge, *Broward II*, owned by the Benton Co. of St. Petersburgh, Florida, operating in Tampa Bay. Built in 1925 and rebuilt in 1959, this Superior dieselized dredge, is the largest shell dredge in the Tampa Bay area.

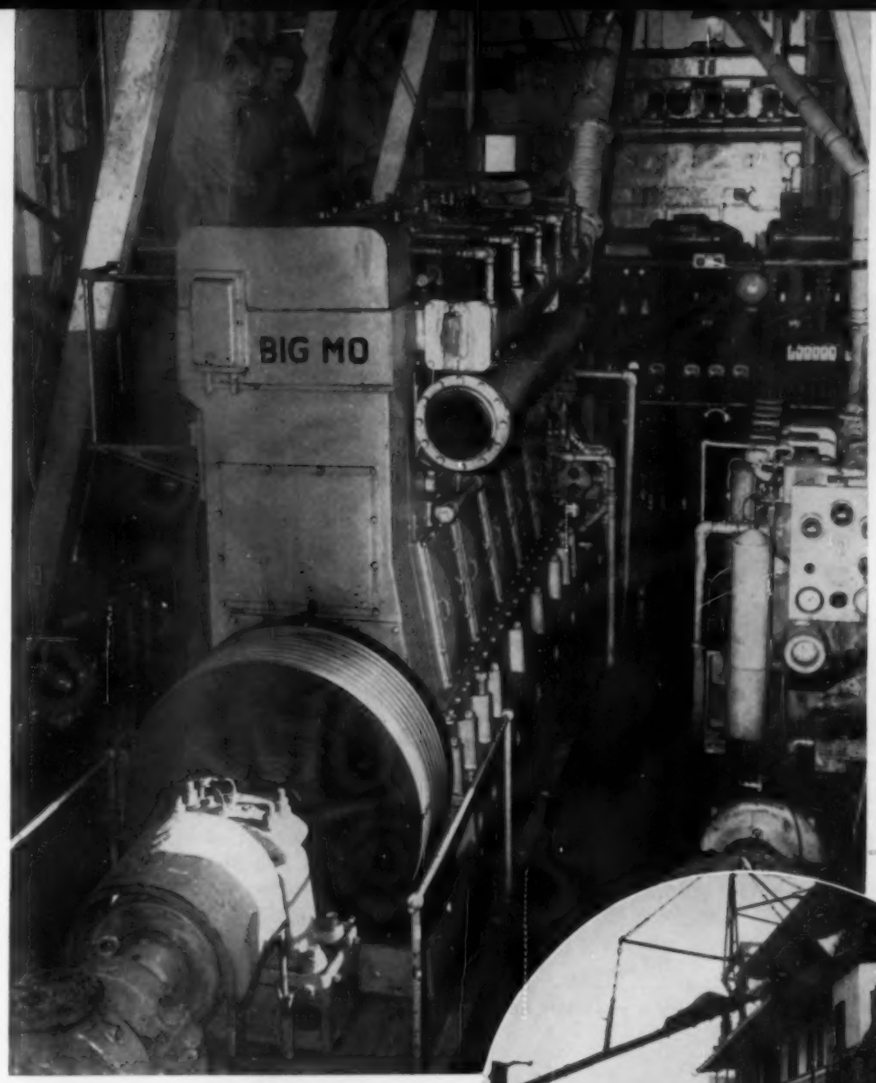
The main generating set consists of a model KNA Superior 11½ in. bore x 14 in. stroke diesel engine rated 420 hp at 514 rpm with a 264 kw Westinghouse 120/240 volt 1100 dc generator. The engine has Luber-finer filters and Nugent strainers in its lubricating system. Also shown is the main switchboard.



This is how the shell dredging operation works, the cutter head digs into the shell bed and the material, approximately 30 percent solids and 70 percent liquids, is pumped through the 18 inch suction pipe near the cutter head, up to the shaker machine located on top of the dredge where it is discharged through a 16 inch discharge pipe out and onto a Simplicity shaker screen. Sea water is pumped by two six in. pumps to spray nozzles located over the screen and the high pressure sea water washes the oyster shell while it is being shaken over the screening. The washed shell is then loaded onto a deck barge via a chute. The sand and unwanted material is washed off in the shaking operation and returned via a 30 in. spoils pipe into the hole where the shell had been removed. The deck barges hold about 500 tons and normally take about two hours to load.

Power for the shell pump is furnished by a 14½ x 20 in. model VDS Superior diesel engine which develops 550 hp at 330 rpm. The engine is mounted on a structural steel foundation built as an integral part of the hull. Also included as a part of the main engine is a Maddox 18 x 16 pump, a Kingsbury thrust bearing, Bodi industrial fuel and lubricating oil filters plus Purolator fuel and lubricating oil strainers.

Cooling is accomplished by a shell and tube type heat exchanger. Lubricating oil and filters are changed about every 1000 hours or approximately a month of operation and Sinclair Rubilene HD30 is used. Fuel consumption runs about 20,000 gallons of No. 2 oil per month for all three diesels.



Louis E. Budd, Chief Engineer on the *Broward II* and James Robbins, sales engineer of the White Diesel Div. White Co., discussing the workings of the model VDS Superior 14½ x 20 diesel which is rated 550 hp at 330 rpm and supplies power for the 18 x 16 in. Maddox shell pump. Also shown in the lower right corner is the 100 kw Superior dieselized standby generator set with a GE generator.

Oyster shell being discharged from the shaker and cleaner, located on top of the dredge, onto a deck barge. The dredge can load about 500 tons in about two hours of operation. Capt. Homer Roberts checks the progress.

The main power for the cutter head, swing motor, barge winch motor and all other electrically driven auxilliaries is supplied by a model KNA, 11½ x 14, Superior diesel which develops 420 hp at 514 rpm and drives a 264 kw, 120/240 volt, 1100 dc, Westinghouse generator. Three Luber-finer lubricating oil filters and two Nugent lube oil strainers are used on this installation.

The stand-by diesel generating set is also Superior powered and consists of a model GDB8 diesel with a 100 kw General Electric generator. An Allis-Chalmers dc to ac motor generator-converter is also included in the electrical installation to convert the dc to ac for the dredge's lights, refrigeration, etc. Compressed air is provided by a two-stage Ingersoll-Rand air compressor.

The *Broward II* is the largest shell dredge in the Tampa area and can sleep and feed a crew of 27 men but most of the crew prefer to live ashore and travel back and forth via the ships swift personnel vessel powered by a pair of GM diesel engines.

The Benton Co., which was started in 1935, operates about 35 diesel engines in its various tugs, dredges, and utility craft. In 1943, the firm was acquired by the R. C. Huffman Construction Co. for its shell dredging operations. The firm, after barging the shell, can stockpile about 24,000 tons at its St. Petersburg and Allen's Creek yards where it is loaded via dieselized cranes onto trucks which deliver it to the various road construction jobs.

MODEL FOR 525 HP UNITS IN NEW TRANSMISSION LINE

THREE new transmissions for applications in varying fields have been introduced and are now in production by the Allison Division of General Motors Corp. One of the transmissions was developed especially for front end loader applications, another for fork lifts in the 10,000 to 15,000 lbs. class and the third for diesel engines in the 525 gross horsepower class used in heavy duty off highway applications. Model designations are: CRT-3531 for the front end loader unit, CRT-3321 for the "fork lift special" and model CLBT-5940 for the 525 hp class assembly.

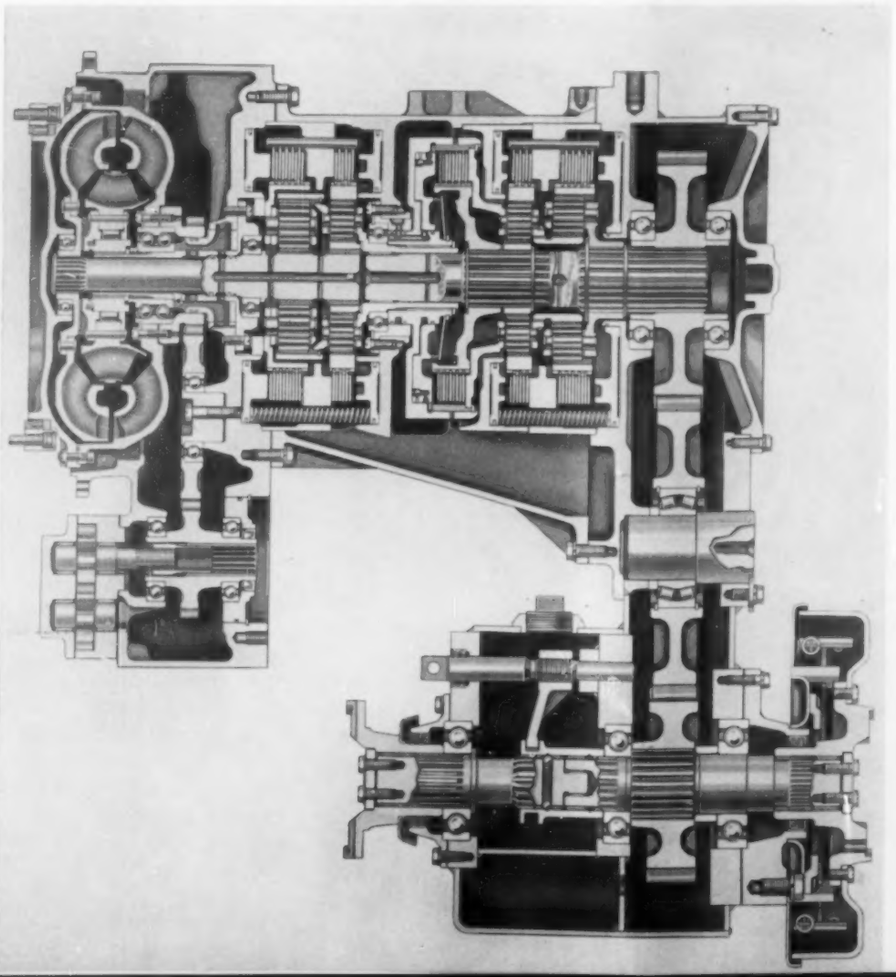
Let's take a look at the three new transmissions starting with the most recently announced model CRT-3321. This unit was designed to handle 300 net foot pounds of engine torque at engine speeds up to 2600 rpm. It is a full forward-reversing unit with two speeds in each range and is a "straight-through" version without the drop box. Torque ratios are 2.91:1 in low and 1:1 in high. Three torque converter selections are available, giving stall ratios of 3.5:1, 2.7:1, or 2.5:1. An optional feature is a special "inching" valve which permits normal clutch operation with high engine speeds when loading or unloading the forks.

Incorporating full torque shifting in all ranges, the transmission is controlled by hydraulic clutches. This transmission is scheduled for installation in heavy duty fork lift trucks being developed by three different manufacturers.

Next in the new Allison line is a heavy duty version of the present front end loader transmission already used by many of the nation's loader manufacturers. Designated the CRT-3531, the new unit is designed to handle 350 net foot pounds of engine torque, at the same time permitting increased hydraulic hp for bucket operation.

The CRT-3531 model is a full torque shifting transmission that includes a hydraulic torque converter in combination with a three speed forward and three speed reverse planetary gear set with a transfer case output for general use in loaders. A special new three element torque converter has been developed that provides high torque multiplication while maintaining with high efficiency. The torque converter has a stall ratio of 3.7:1, which coupled with the low range (8.00:1) provides an overall engine torque multiplication of 29.6. Forward gear ratios are 8:1 in low, 2.90:1 in intermediate and 1.00:1 in high. Reverse ratios are 7.75:1 in low, 2.81:1 in intermediate and .97:1 in high. This transmission is available for either engine or remote mounting, with front output mechanical disconnect, transmission or remote-mounted oil cooler and drum type parking brake. The implement pump drive has an intermittent rating of 80 hp and continuous rating of 50 hp. Total weight of the transmission is 1170 to 1260 lbs., depending on the options selected.

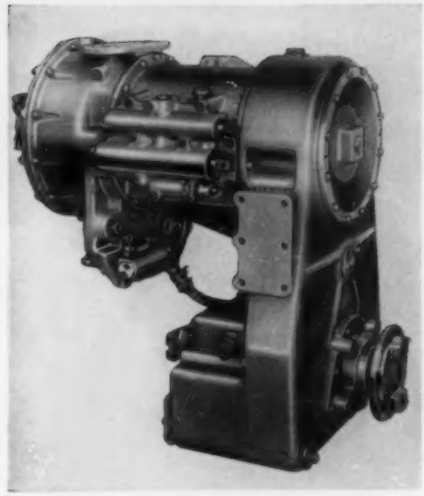
Cutaway drawing of model 3531 Allison transmission for front end loader applications.



The CLBT-5940 transmission is the latest addition to Allison's 5000 series and is a "big brother" to the 5640 and 5840 models. The 5940 unit provides a durable and rugged transmission to match the larger automotive type diesel engines being developed delivering up to 525 gross horsepower. This transmission includes a 17 in. Torqmatic converter, lock-up clutch, optional integral Torqmatic retarder, four forward speed range and one reverse range. Installed ahead of the gear train, the retarder gives braking assistance in all forward speeds, a feature which materially reduces vehicle service brake wear and relining expense. A split range valve body, standard on all 5940 models, provides automatic splitter shifts in first, second, fourth and reverse ranges, giving the unit six speeds forward and two speeds in reverse. The splitter shaft results in closer ratio steps, a higher hp level and improved shift characteristics.

The CLBT-5940 can be direct engine mounted or remote mounted with either a straight-through or transfer case output. Engines currently approved by Allison for use with the 5940 model transmis-

Harold B. Dice, left, Allison general manager and Keith H. Hoffman, Transmission operations manager, inspect one of the new heavy-duty CLBT-5940 transmissions as it comes off the assembly line. Unit is designed for use in off-highway vehicles with engines in the 525 gross hp class.



Model CRT-3531 transmission is full torque shifting unit with hydraulic torque converter in combination with three speed forward and reverse gear set with transfer case output.

sion include the Cummins NVH-525 and GM Detroit 6-71-70 Twin. The following represent overall transmission gear ratios on the 5940:

Transmission Range Selector Valve Position	Gear	Ratio
First	Low	4.00:1
	High*	2.68:1
Second	Low	2.01:1
	High*	1.35:1
Third	Hold Position	1.00:1
Fourth	Low	1.00:1
	High*	.67:1
Reverse	Low	5.12:1
	High*	3.40:1
Transfer gear ratio		1.00:1

*Automatic shift

The 5940's high capacity three element Torqmatic converter multiplies engine torque 255 per cent at stall, prevents engine lugging and automatically provides correct torque delivery in all ranges. Improved planetary gearing and advanced clutch design allows full torque shifting with a continual uninterrupted flow of power to the driving wheels. Maximum input net torque of the unit is 1200 lbs. ft., maximum input engine speed is 2500 rpm while the maximum net horsepower input is 450.

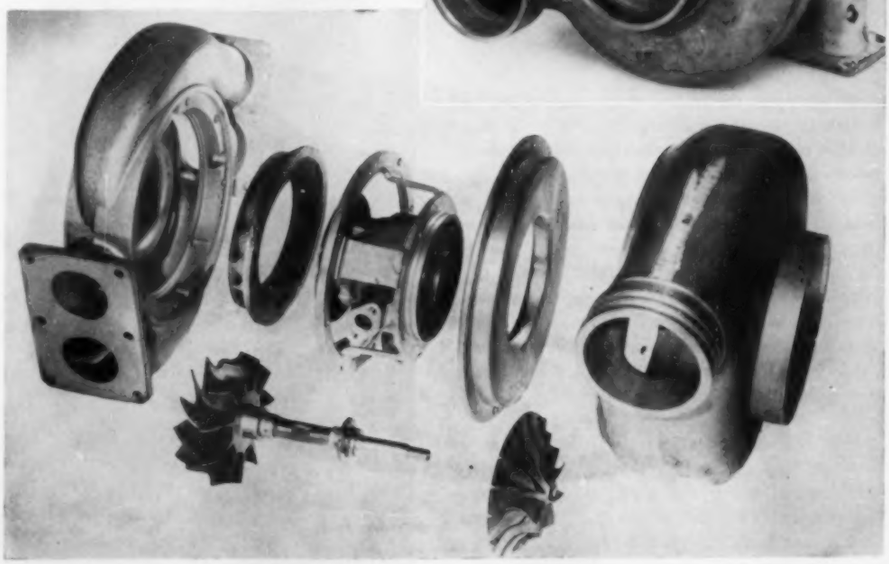
Torqmatic transmissions in the 5940 class are already available in heavy duty trucks manufactured by the Euclid Division of GM, LeTourneau-Westinghouse, Dart Truck Co., and Mack Trucks. Several other large manufacturers also plan to offer this unit in upcoming months. Dry weight of the basic CLBT-5940 unit is 2100 lbs.

TURBOCHARGER FOR LARGER, OFF-HIGHWAY VEHICLES

A TURBOCHARGER designed for the largest class of vehicle type diesel engines—those of 500 hp and above—has been developed by The Garrett Corporation's AiResearch Industrial Division. AiResearch's new unit, the T-24, has a turbine and compressor designed specifically to fit the broad operating characteristics of diesel engines that power vehicles in off-highway and construction service. It is particularly adaptable to new V-type engines now being developed, and for use with controlled and intercooled applications. For application to V-type power plants, a turbine housing with inlets on opposite sides can be provided.

Compressor of the T-24 can operate over a broad range of flows and pressures at high efficiencies. At the same time, its turbine operates at maximum efficiencies at low engine speeds to give the vehicle engine good response and lugging characteristics. The rotating assembly is designed for low moment of inertia and rapid response to engine power changes. Turbine and compressor can be tailored to meet a wide range of specifications. Frame of the T-24 is an enlarged version of a design used in an earlier AiResearch turbocharger. Compressor components are of aluminum and a special high-strength alloy is used for the impeller. Center housing is of malleable iron, and the turbine housing of high ductility iron.

AiResearch T-24 turbocharger.



Exploded view of T-24 turbocharger shows from left, turbine housing, nozzle ring, center housing, diffuser plate, and compressor housing. In the center foreground are the turbine wheel on its shaft and the compressor wheel.

Desert Rig No. 2 is shown during final tests before shipment to Libya. Rig uses eight Caterpillar engines for draw-works and pump, electric power.

MOBILE RIG FOR DESERT OIL SEARCH

RELIABILITY, from engine to rotary table, draw-works and slush pumps, is emphasized in a new, huge trailer-mounted drilling rig. Latest in the Ideco, Inc., series of Desert Ramblers, giant "Desert Rambler No. 2," was built for Camdrill International, Inc., to drill the booming Libyan oil fields. While similar in many details to Camdrill's Desert Star No. 1, the rig contains a number of later refinements.

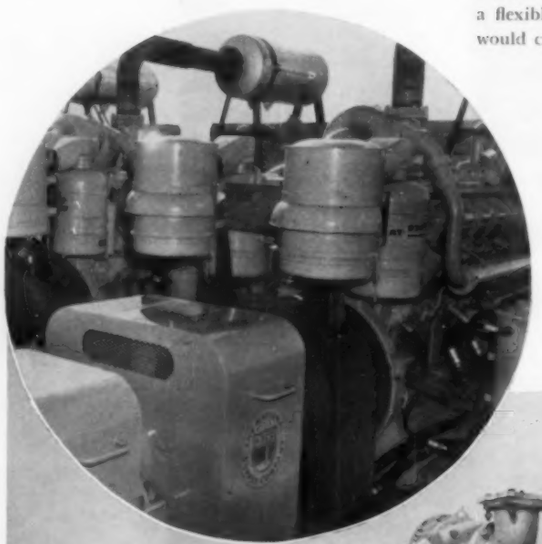
Completely self-contained, the new Desert Rambler moves up to 1400 mi. cross-country across roadless North African sands on five huge semi-trailers. Haulers are five Kenworth diesel trucks. Rig engines are modified to burn any available oil—including crude. The Desert Rambler No. 2 is designed to drill to 10,000 ft. with 4½ in pipe. It operates directly from its transport trailers, one each carrying mast, and draw-works, two accommodating slush pumps and mud system, and the fifth equipped with a complete maintenance shop.

Fully equipped, the trailers weigh from 68,006 to 159,000 lbs; length varies from 47 to 78 ft.; a total of 1500 hp is supplied to the draw-works, rotary table and pumps by four Caterpillar D397 engines. Four Cat engine-generator sets provide a total of 330 kw of electricity for auxiliary equipment and lighting. Two D342 sets supply power for the rig requirements, two D339 provide for camp site electricity. All engines are equipped with oversize radiators to cope with 130° desert heat. Dual fuel and air filters and stainless steel injectors make possible the use of low grade diesel fuel or high-sulfur crude as fuel.

The draw-works trailer contains an Ideco double-drum drilling and workover hoist plus two Cat D397 engines driving through 24 in. Clark torque converters with 3:1 stall torque ratio. Draw-works and rotary table are driven by this package through a three-shaft compound. In drilling position, the mast trailer is connected back-to-back with the draw-works trailer and the 127 ft. mast raised from the horizontal carry position. A 300 hp slush pump mounted on a separate trailer is driven by the third D397. The fourth trailer contains an Ideco 600 hp slush pump driven both by the fourth Cat engine and a propeller shaft from the draw-works compound.

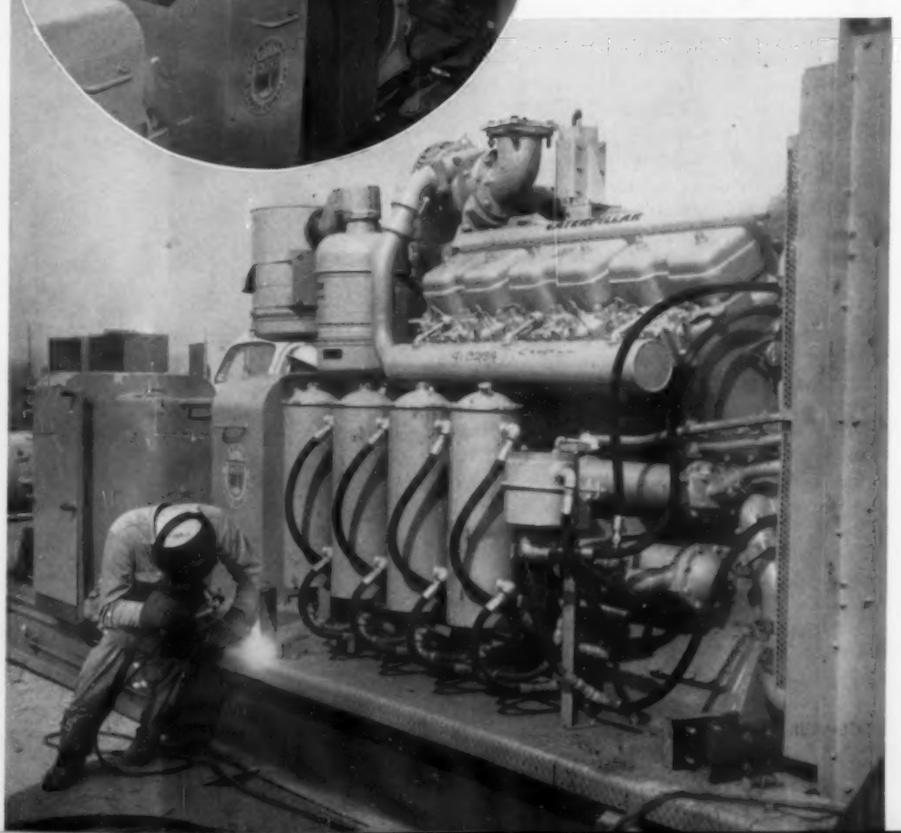
The turbocharged Cat D397 diesel can develop 650 max. hp at 1300 rpm. The 12 cylinder unit has a 5¾ in. bore and 8 in. stroke for total 2493 cu. in. displacement. Operating conditions of these Cat engines were set at somewhat reduced horsepower to prevent overloading the draw-works and to extend engine life.

"Since the slush pump is chain driven, it is necessary that the torque converter take a side load," said Ned W. Fowler, Ideco chief engineer. "By using a converter with an output shaft capable of supporting the side load, additional shaft bearings and a flexible coupling are eliminated. If the torque converter could not support the side load imposed by the drive chain," he said, "it would be necessary to mount a shaft assembly with two bearings in line with the torque converter output shaft and connect it to the converter shaft with a flexible coupling. This way the auxiliary shaft would carry the load."



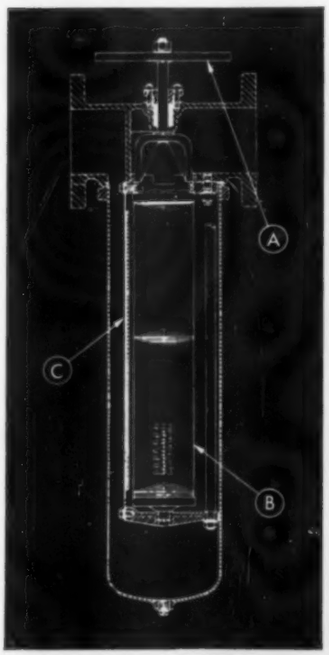
Rotary table and slush pump power is provided by Cat D397 diesel engines driving through Clark 24 in. torque converters. Engines for the rig are equipped with dual Donaldson Donaclone precleaners and dual oil bath air cleaners for protection from dust and sand, special fuel filters for operation on crude oil.

Welder at work on platform for D397. Engine is turbocharged V-12 unit rated 650 max hp at 1300 rpm.



PERMANENT, UNINTERRUPTED ENGINE FILTRATION

CLEANING the Purolator Series G-144J Metal Edge Filter is done by an occasional twist of hand wheel (A). This rotates Metal Edge Filter Element (B) so fixed knife blade (C) shears waste off the element as it rotates. Accumulated waste is periodically removed through plug at bottom of case. If service requirements warrant, filter element can be rotated continuously by motor drive.



Designed for filtering fuel or lube oil, Purolator Series G-144J Metal Edge Filter will make your engine last longer.

Because it's made of precisely-spaced metal ribbon wound into cylinder form, the Purolator Metal Edge Filter element will last almost indefinitely.

Maintenance is negligible. An occasional twist of the hand wheel on top of the unit cleans the filter element...keeps it working at top efficiency. There's no need to cut off the engine, or to interrupt the flow of oil.

This filter can be installed on either the suction or the pressure side of the pump and includes a relief valve. Degree of filtration ranges from 25 to 500 microns to suit your fluid requirements. For complete details, write Purolator Products, Inc., Dept. 4845, Rahway, New Jersey.

Filtration For Every Known Fluid

PUROLATOR

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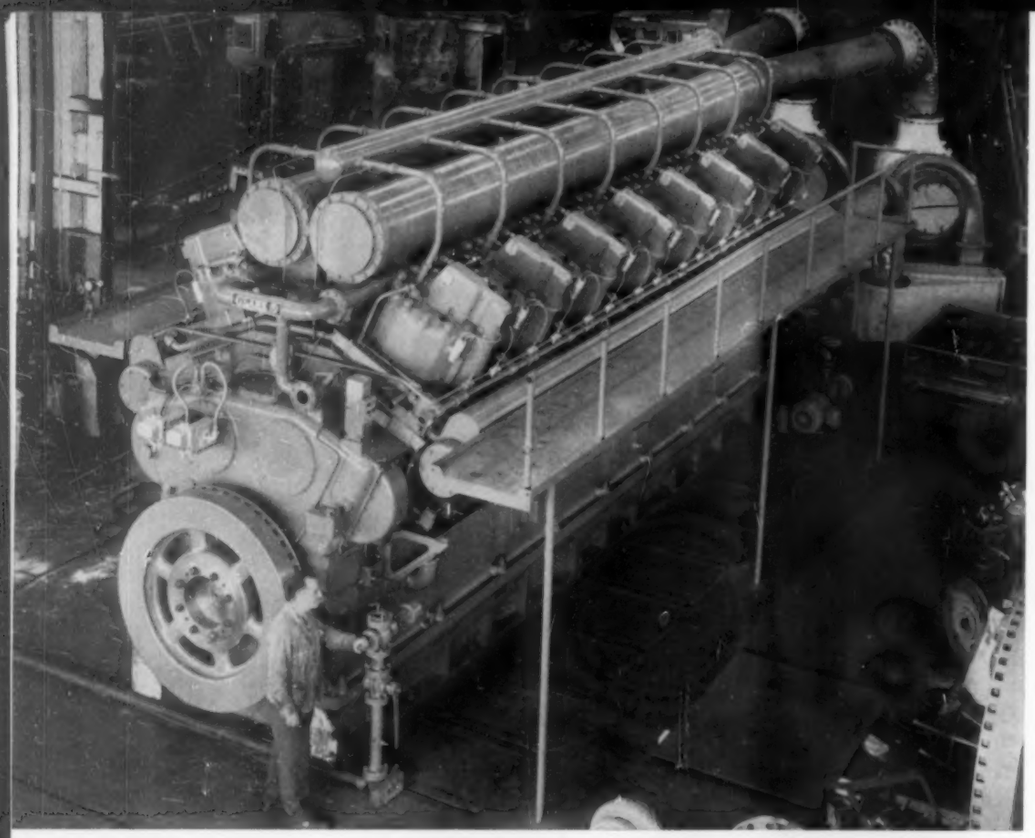
Rahway, New Jersey and Toronto, Ontario, Canada



Clark model TCV-16, 5500 bhp turbocharged, 2 cycle V-type engine-compressor shown during assembly at factory. Turbochargers can be mounted on the engine or away from engine. Note Marquette governor.

5500 BHP V-TYPE GAS ENGINE-COMPRESSOR

A HIGH horsepower, V-type gas-engine-driven compressor with compressor cylinders on one or both sides of the crankcase has been introduced by Clark Bros. Co. Designated model TCV, this turbocharged, 2 cycle machine will be built in 12 and 16 power cylinder models rated at 4000 and 5500 bhp respectively. The use of compressor cylinders on one or both sides of the crankcase makes maximum use of available space and provides cylinder flexibility for a wide range of operating conditions. The TCV-16 can be fitted with as many as eight large cylinders to handle all types of pipeline and process requirements including multi-service applications where several gas streams are compressed by one machine.

Many features have already been proved in Clark TLA engine-compressors and the TPV gas engine, including 12 in. x 19 in. bore and stroke, three-piece articulated power connecting rod assembly, side-by-side compressor cylinder connecting rods, and constant pressure jet air started turbocharger. Featuring a husky 15½ in. crankshaft, the engine operates over an unusually wide safe speed range —180 to 300 rpm. The conservative 102 bmep rating is designed to assure low stress, long component life, high reliability and ample reserve capacity to handle temporary overloads. The TCV was designed to handle variable-speed, variable-load applications and perform smoothly at substantial speed reductions when torque is held at a constant level.

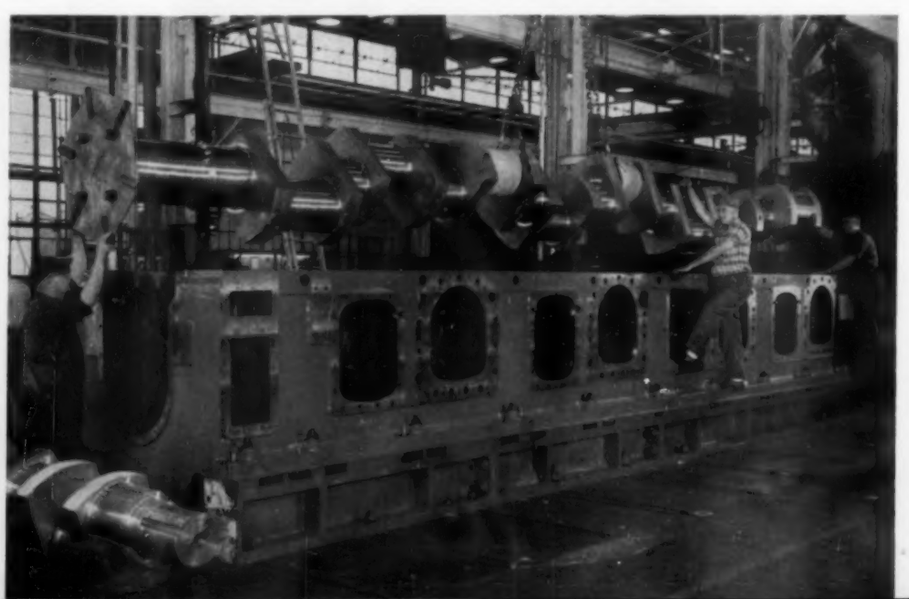
The TCV is equipped with two turbochargers, one for each bank of power cylinders. Throughout the normal operating range, the turbocharging system is completely self-sustaining and produces a flexible supply of combustion air to match engine requirements over all speed and load conditions. An automatic ignition control combines with the turbocharger to provide good response, good speed control and low fuel consumption over a wide range. The turbocharger along with external fin and tube type scavenging air intercooler may be mounted on the engine or away from the engine, either inside or outside the building.

The cylinder block is cast of semi-steel to insure maximum rigidity and permanent alignment of the power cylinders. Power pistons are the two-piece oil cooled type. Removable, water cooled power cylinder liners in the block carry no tention loading of the power cylinder heads, hence are free to expand as the engine comes up to operating temperature. The lower crankcase is cast of fine-grained, semi-steel with precision bored integral main bearing supports. Crossbolts tie the top edges of the case together, insuring greater rigidity and better load distribution.

The heavy, one-piece chankshaft is forged from high tensile strength steel. Each crankpin on the shaft carries a master and link rod for the power cylinders and a horizontal compressor rod alongside the articulated power rod assembly. The horizontal rods and compressor cylinders are arranged alternately to the left and right side of the engine. The three piece articulated rod assembly includes a master rod with cap which carries a link rod. For gas transmission, the TCV can be furnished with Clark high efficiency, low ratio pipeline compressor cylinders. Developed with the help of digital and analog computers, these cylinders feature large internal manifolds streamlined to avoid turbulence and pressure drop, large area nylon poppet type valves, and oversize suction and discharge nozzles to keep velocities low. Use of nylon poppets has for all practical purposes eliminated maintenance. In actual use, these valves have delivered over 40,000 hours of service without a single shutdown. Because of the high free lift area, the pressure drop across the valve is quite substantially reduced.

Other features include aluminum main and connecting rod bearings, full pressure lubrication, fully insulated exhaust manifolds, enclosed and lubricated fuel injection valve gear, large capacity precision gear type oil pump, and a centrifugal water pump for cooling services.

Crankshaft being lowered into lower crankcase of new Clark model TCV gas engine driven compressor. Note huge proportions of case and shaft forging.



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DIESEL SERVICE PROGRESS

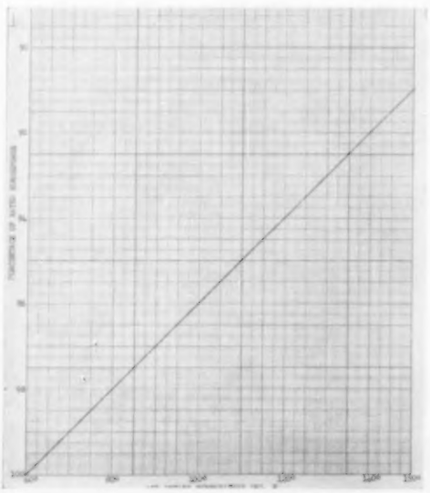
A COMMENTARY BY GEORGE R. MACKEY

George R. Mackey was long associated with Detroit Diesel Engine Division of General Motors Corp., and had prior experience as a mechanic in Europe and the U.S.A., which enabled him to become well acquainted in the diesel and service fields and to obtain a broad scope of the service industry from the customer's and management's viewpoint. Further training at Carnegie Tech and in the Army Ordnance during World War II provided the necessary requirements in planning service programs. Progressive advancement in diesel service areas in General Motors and with Detroit Diesel led to his position as Supervisor of Service Promotion. Upon termination of employment with General Motors in 1952, he joined Clayton Manufacturing Company, and his present position with this organization is Sales Manager of the Dynamometer Division.

Air–Fuel–Power

THE maximum horsepower developed in an engine is governed primarily by its ability to breathe as the volume of air entering the cylinders determines the amount of fuel that can be burned. Thus, for practical considerations we can assume the physical dimensions of the cylinders are the limiting factors which control power ratings, as the engine size actually limits its breathing capacity. While the volume of air taken into the cylinder is directly proportionate to engine speed, the actual variation in power and speed is controlled by the rate of fuel injection. At a constant speed operation the volume of air "breathed" into the engine would be relatively constant with the amount of fuel burned proportionate to the power demands. Thus, the air/fuel ratio also changes with the engine load demands, and one part of fuel may be mixed with 20, 30 or even 50 parts of air. Generally, it can be said, the diesel engine power output will continue to increase by increasing the fuel rate until there is insufficient air to burn the fuel. Beyond this point more power will not be obtained, regardless of how much fuel is introduced to each combustion chamber.

Fig. 1. Percentage of engine power vs. air temperature. A relatively cool volume of air is heavier than a like volume of warm air, thus contains more available oxygen to burn with fuel.



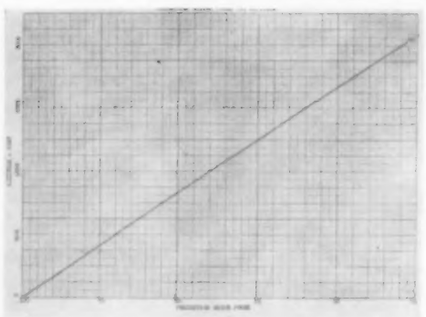


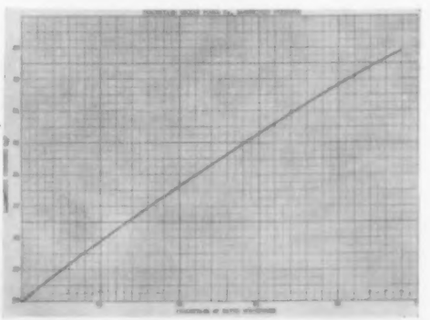
Fig. 2. Percentage of engine power vs. altitude. Engine will breathe denser air at sea level. At higher altitudes air is thinner and there is less oxygen to burn with the fuel.

The engine's breathing ability is the reason manufacturers apply certain correction standards when rating the power capacity. These standards are based upon uncontrollable variables which affect the volume of air entering the cylinders, namely altitude, barometric pressure and temperature. The maximum power an engine delivers decreases with an increase in altitude above that stated as standard by the manufacturer. Likewise, the power output decreases with lower than specified barometric pressure, or higher air temperature. The resultant lowering of atmospheric density, experienced with higher altitudes, lower barometric pressures, and higher air temperatures, decreases horsepower output due to a diminished amount of oxygen available for complete combustion. The percentage of net brake horsepower rating for naturally aspirated engines rated at sea level with air 60 degrees F., operating at various altitudes, temperatures and barometric pressures, is illustrated in Figures 1, 2 and 3.

Standard practices applied by most diesel engine manufacturers, in respect to guarantees of horsepower capacity and fuel consumption are based on actual tests conducted in their own test facilities. These tests are contingent upon the air pressures and temperatures as well as a fuel oil having a specific heat value (Btu's) per pound. The published fuel consumption is rated in fractions of a pound of fuel per horsepower hour. All of these variables are independent of one another, and, in some cases may operate adversely in a cumulative way. Fuel consumption rate becomes greater than specified with an increase in altitude above that considered as standard. For example: a 200 hp engine might have a sea level full load fuel consumption rating of 0.40 lbs./bhp/hr., but at 8,000 ft. the full load fuel rate might be increased to 0.526 lbs. unless means are provided to crowd more air in the cylinder, or de-rate the amount of fuel injected to compensate for altitude. The difference in these fuel rates is due principally to the variation in full load ratings at the higher altitude. While at sea level the engine developed 200 hp, it would only develop 152 at 8,000 ft., but the same quantity of fuel would be injected under both operating conditions. The variations in the weight of air in pounds per cubic foot at different barometric pressures and temperatures are shown in Figure 4.

To compensate for high altitude operation and to provide more power per engine size, superchargers

Fig. 3. Percentage of engine power vs. barometric pressure. When accuracy of engine power measurement is important, compute power loss by applying maker's barometric standard and existing pressure.



WEIGHT OF AIR IN LB. PER CU. FT. AT DIFFERENT BAROMETRIC PRESSURES & TEMPERATURE

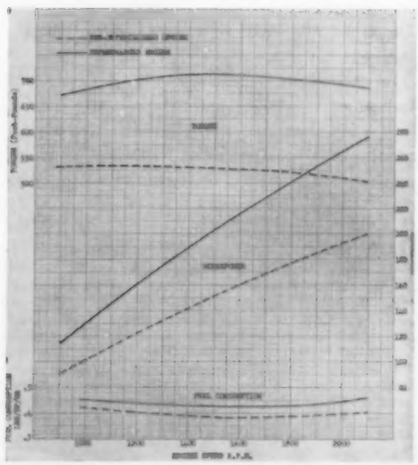
Temp. deg. fahr.	Barometer readings, inches of mercury								
	28.5	28.6	28.5	28.7	28.9	30.1	30.3	30.5	31.0
50	0.07381	0.07512	0.07642	0.07696	0.07746	0.07798	0.07850	0.07902	0.08032
55	0.07302	0.07431	0.07560	0.07612	0.07663	0.07715	0.07766	0.07818	0.07947
60	0.07226	0.07352	0.07479	0.07530	0.07581	0.07632	0.07683	0.07734	0.07862
65	0.07145	0.07272	0.07398	0.07449	0.07499	0.07550	0.07600	0.07651	0.07777
70	0.07067	0.07192	0.07317	0.07367	0.07417	0.07467	0.07518	0.07568	0.07693
75	0.06988	0.07112	0.07236	0.07286	0.07335	0.07385	0.07434	0.07484	0.07608
80	0.06909	0.07032	0.07155	0.07204	0.07253	0.07302	0.07351	0.07400	0.07523
85	0.06829	0.06950	0.07072	0.07121	0.07170	0.07218	0.07267	0.07316	0.07437
90	0.06748	0.06868	0.06989	0.07037	0.07085	0.07133	0.07182	0.07230	0.07351
95	0.06666	0.06785	0.06904	0.06952	0.07000	0.07048	0.07095	0.07143	0.07263
100	0.06583	0.06700	0.06818	0.06864	0.06913	0.06960	0.07008	0.07055	0.07174

Fig. 4.

are often used to force more air in the cylinders. This results in complete combustion of fuel at given altitudes, or provides for the burning of more fuel at sea level with a resulting increase in horsepower. The history of superchargers dates back to the earliest days of diesel engines, in fact, Dr. Rudolph Diesel tried to apply a form of supercharger to one of his engines, but was not very successful. Since then, there have been many different versions invented in the search for the best method. Supercharging of diesels has become increasingly popular, and presents certain aspects that may be very appealing to many types of operations, as it . . . (1) provides for a reduction in engine weight for a given horsepower, and less weight means more pay load for trucks and other vehicular types of operations. (2) reduces engine size. This can be important on mobile equipment as smaller engines can result in less wasted space, more compact installations, and smaller and lighter frames which again saves weight and increases the pay load. (3) can result in reducing the cost of the engine, as the cost of manufacturing a large engine may be greater than the cost of a smaller engine, plus the supercharger. (4) increased economy. A comparative performance of supercharged and non-supercharged engines is illustrated in Figure 5.

Any means employed to supercharge or force more air into the combustion chamber will result in air inlet pressures above atmospheric. It can be determined from the comparative chart, that providing additional air by supercharging permits complete burning of a larger fuel charge, with a resulting increase in horsepower.

Fig. 5. Comparative performance of supercharged and non-supercharged diesel engines.



WATER/SEPARATOR FILTER FOR DIESEL FUEL

A new filter separator which removes water, even finely emulsified, from diesel fuel has been developed by Filters, Inc., Milpitas, Calif. The unit is a true coalescer. It does not absorb or block the water but rather aglomorates the droplets into globules which readily settle into a sump. The galling or scoring effects of water on fuel injectors and pumps are well known. In fact many diesel engineers now believe that water is the greatest single cause of the need for injector overhaul. Also, water can erode the injector opening as it flashes to steam and from there cause carbon in the cylinder.

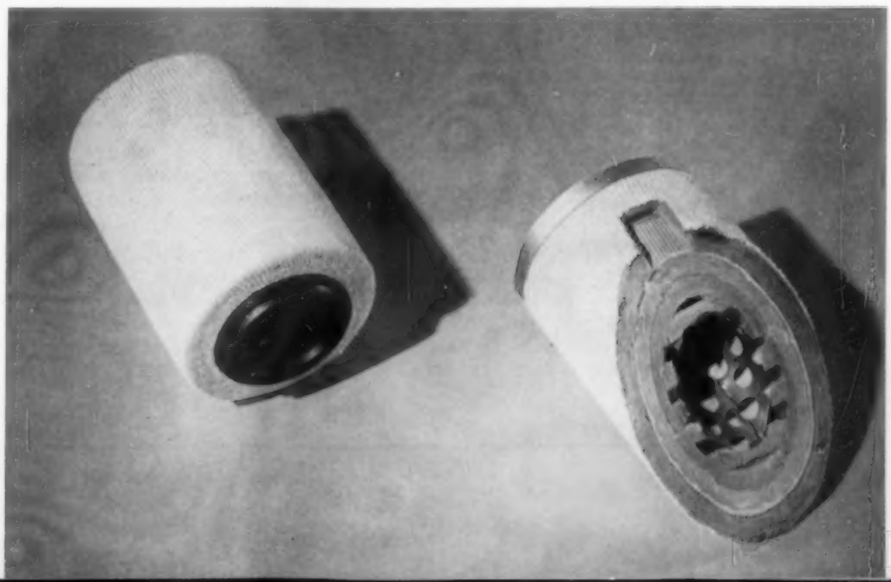
The Filters, Inc. unit, which is designed to fit most automotive and stationary diesels, utilizes a fiberglass media to both coalesce water and entrap submicronic contaminant. Fiberglass is among the best materials for achieving coalescence. The glass and water are both so called "polar" materials, hence a degree of attraction exists between them as the emulsion of fuel and water passes through. This attraction causes the minute water droplets to cling to the adjacent strands of glass and be retarded in their flow out through the filter. These droplets merge on their passage outward through the filter growing larger and larger as other droplets attach themselves. The enlarged gobule finally emerges on the surface where it falls rapidly to the sump in the bottom of the filter. Settling droplets average $\frac{1}{8}$ to $\frac{3}{16}$ ins. dia. and settle very rapidly because of their greater density than fuel. In addition to its coalescing properties, fiberglass has other features. It is non-hydroscopic, in other words water cannot penetrate the fibers and cause swelling. It is impervious to fungus. There is no deterioration of the element and changes are necessitated only by particle contamination causing the flow to be restricted.

In utilizing the fiberglass media, a number of layers of glass are wrapped perpendicular to fuel flow. The various porosities of each wrapped layer provide staged filtration or the removal of different sized particles at respective depths of penetration. A fiberglass screen wrap provides a bursting strength of over 75 psi. This new separator, designated as model I-500, is rated at 1 gpm maximum flow rate although pressure drop on the clean filter is 1.3 psi and water removal performance remains high to 1.5 gpm. For larger flow rates, units can be mounted in parallel. According to Filter Inc. engineers, at rated flow of 1 gpm of clean fuel, the pressure drop is .9 psi. This represents element resistance as there is negligible drop across the housing alone. Also at the standard maximum water test of 3 per cent and at flow rates up to 1.5 gpm, no free water is present in the effluent utilizing the Shell detector test.

As a contaminant filter, model I-500 reportedly leaves no more than 0.5 mg./liter of Fisher I-116 ferric oxide when 80 mg./liter are added to the influent. The particle distribution is such that 44.8 per cent of the particles are less than .25 micron and 100 per cent less than 10 microns. Thus, as a final stage filter the I-500 is very efficient. The contaminant holding capacity in terms of the red iron oxide is about 60 grams at 20 psi differential. In terms of A C fine dust, it is 80 grams at 15 psi drop. A C coarse dust, because it does not penetrate as much to the more dense layers, will reach a load of over 200 grams before 15 psi differential is attained.

The element is 5 in. long, $3\frac{3}{4}$ in. dia. and is designed for inside-out flow. The case is approximately 11 in. long and 5 in. dia. in order to provide adequate settling and sump areas. Inlet is to the center of the element, outlet at the extreme top and sump drain at the bottom. Fittings and mountings allow it to be mounted on any engine. Changes of elements are recommended only when power lags due to fuel flows being restricted by contamination.

Here is the new Filters, Inc. water/separator filter. Element is shown to the left and note the double knife edge dam type gasket. The cutaway section shows the multiple layers of fiberglass, the deep grooving and screen wrap.



New Robertshaw Research Center

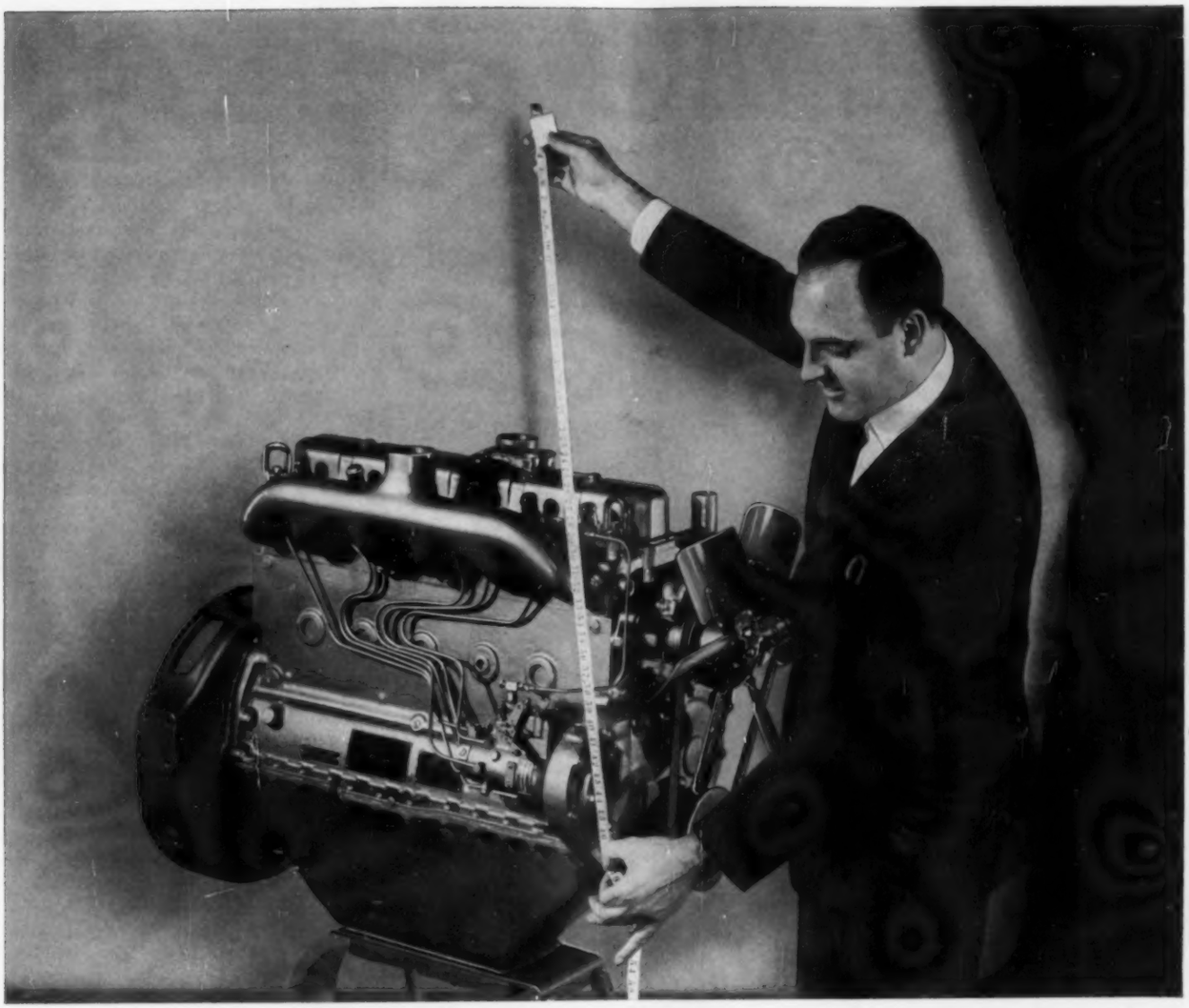
Robertshaw-Fulton Controls Company's new Eastern Research Center at King of Prussia, Pa., devoted to research and development of appliance, industrial and military control devices, was opened officially late in September. The research facility, a

long one-story structure of field stone, brick and aluminum exterior construction, occupies a high point of land in the rolling Pennsylvania countryside near historic Valley Forge. Its 18,000 sq. ft. provide laboratory, test, and office space for approximately 50 employees working in the fields of chemistry, physics, electronics, mechanics, gas technology, and air-conditioning. The building was completed in 1959 at a cost of approximately $600,000. Robertshaw-Fulton, a manufacturer of automatic temperature and pressure control devices, instrument systems, and electrical switches and relays, has its corporate headquarters in Richmond, Virginia. The company has eight U.S. manufacturing divisions—one of them in Knoxville, the Fulton-Sylphon Division, which manufactures controls for the diesel and gas engine industry. Subsidiaries or affiliates are located in six other countries. Scientists and engineers at the King of Prussia center are engaged primarily in research and development of electronic, electromechanical, pneumatic and thermal devices: heating and refrigeration systems, and process control systems. They work under the supervision of Mr. Wm. M. Harcum as general manager and George Revesz as technical director. Day & Zimmerman of Philadelphia designed and built the new center.

Continental Sales Manager

W. D. Brumback

William D. Brumback has been named sales manager for Continental Machinery Corp., Compton, Calif., U. S. distributor for Yanmar diesel engines for marine and land auxiliary use. Prior to joining Continental, Brumback was vice president and general sales manager for American Marc. Previously he has served as vice president and general manager with Hallett Mfg. and as west coast manager for Hercules Motors. His appointment was announced by Carl B. Hayward, president of Continental Machinery Corp.



Engines are tailored, too

There's a full staff of custom tailors working at Hercules. Sound odd for an engine manufacturer? It isn't, really. Not when you consider that many of our customers require engine alterations. They want engines that are tailored to fit their particular application. And this is where Hercules shines.

For example, Hercules can put the manifolds almost anywhere you want them. You can have a "right-hand" or "left-hand" engine. And, Hercules designs its engines so that extra large accessories like hydraulic pumps, air compressors or generators can be readily accommodated. For flexibility in fuel selection, Hercules has developed companion gasoline, LPG and diesel engines of identical dimensions, with a maximum of parts interchangeability.

These are just a few of the ways custom tailoring at Hercules works to meet the requirements of engine users. Possibly Hercules can help to fill *your* power needs more exactly—more economically. Why not meet with us and see?

HERCULES

HERCULES MOTORS CORPORATION
Canton, Ohio

Gasoline and Diesel Engines from 15 to 500 horsepower

J. E. DeLong Retires, C. E. Nelson New Waukesha Motor Co. President

J. E. DeLong

C. E. Nelson, Jr.

James E. DeLong, president of the Waukesha Motor Co. of Waukesha, Wis. has announced his retirement. Mr. DeLong has served as president for the past 25 years. At a meeting of the board of directors of the company, following the annual stockholders' meeting, the directors accepted Mr. DeLong's decision to retire, and elected as his successor Charles E. Nelson, Jr., formerly executive vice president. Other officers elected were J. G. Swain, vice president, and L. W. Youker, secretary and treasurer. N. H. Willis was appointed vice president of Engineering and J. J. Kleinbrook was appointed assistant secretary and assistant treasurer. Mr. DeLong entered the internal combustion engine field with the Rutenber Motor Co. of Logansport, Ind. In 1919, he became plant manager of the Indiana Truck Corp. and, in 1923, joined the Waukesha Motor Co. as an oil field sales engineer, advancing to plant manager in 1928. He was elected a director and vice-president in 1932, and four years later became president and general manager. Under Mr. DeLong's direction the company has grown to be one of the largest independent manufacturers of heavy duty industrial combustion engines, with plants in Waukesha, Clinton, Iowa, and Houston, Tex. Charles E. Nelson, Jr., joined the Waukesha Motor Co. in 1929. In 1933 he was named secretary and treasurer of the Fageol Truck and Motor Coach Co. of Oakland, Calif., at that time a subsidiary of the Waukesha Motor Co. Returning to Waukesha in 1934, he became factory production manager, and after holding various other positions in subsequent years, in 1957 was elected executive vice president. He has been active for many years on the executive committee of the Internal Combustion Engine Institute, the Department of Defense Internal Combustion Engine Industry Advisory Committee on Engine Standardization, and the Engine Standardization Review Committee of the Corps of Engineers.

C. Lee Cook Sales Agent

R. C. Moore

Robert C. Moore, of New York, has been appointed New York and New England sales agent for C. Lee Cook Co., manufacturers of precision piston rings and metallic packings and rings for piston rods. Moore was formerly with the marine sales department of the Gulf Oil Corp. He graduated from the State University, New York Maritime College, Fort Schuyler, New York, and is an honorary graduate of the United States Merchant Marine Academy, Kings Point.

Truck Exhaust Pyrometer

A new pyrometer which protects diesel engines and turbochargers by monitoring exhaust temperatures is now available from the Alnor Instrument Co., Ill. The instrument was developed in cooperation with a truck manufacturer and described in our August 1960 issue. By keeping an eye on the dashboard mounted indicating instrument, the driver is able to select the best, most economical truck gear ratio for any load, road or speed condition. The Alnor exhaust pyrometer is available as original equipment or fleet field application. For further information write Alnor Instrument Co., Division of Illinois Testing Laboratories, Inc., Room 508, 420 N. LaSalle St., Chicago 10, Ill.

ITS NEW

Erie Forge & Steel President

H. C. Lackey

Emil H. Lang, chairman of the board of Erie Forge & Steel Corp., has announced election of Homer Clarkson Lackey as president, director, and chief executive officer. From 1921 to 1942 Mr. Lackey was connected with the Midvale Company, Philadelphia, engaged in the manufacture and sale of forgings and castings. During the war years 1942, to 1945, he served as an officer, Ordnance Department, United States Army. Following his years in the service, Mr. Lackey became district manager of sales for the Midvale Co. in Detroit and Cleveland from 1945 to 1947, and area manager of sales for the same company in Chicago from 1948 to 1950. He joined the Carnegie-Illinois Steel Company in 1950 as staff assistant to the general manager of sales, and since 1951, has been manager—forged products, United States Steel Corp., with headquarters in Pittsburgh.

Form Special Products Unit

J. G. Rongitsch

Formation of a new division to specialize in custom machining and finishing of industrial and automotive engine components was announced recently by Hercules Motors Corp. president, P. O. Peterson, who described the market as one with a multi-million-dollar potential for Hercules. The Special Products Division, as it is called, will be headed up by Joseph G. Rongitsch, assistant to the president, who will have responsibility for over-all direction of the operation. Initially the division will handle custom machining and engineering operations for outside firms on such engine components as engine heads, transmission housings and other major parts and assemblies. Already available are modern precision types of machine tools along with facilities which allow for a wide adaptation of tooling and volume production. Rongitsch was material controller and director of supply and inventory at Hercules before his promotion to presidential assistant recently.

Michigan-Ohio News

By Jim Brown

CYRIL J. Burke, Inc. of Detroit reports sale of a ¾-yd. Northwest model 25D pullshovel powered by a Murphy 11 diesel engine. The new Northwest was purchased by Charles J Rogers Construction Co. of Detroit.

GOLCHEFF Excavating Co. of Mt. Clemens, Mich. has accepted delivery on a new Allis-Chalmers HD11E crawler with an 11-HS hydraulic dozer blade. Sale was made by Earle Equipment Co. of Detroit.

AN International model TD-6 with hydraulic dozer blade was recently delivered to Superior Installers & Excavators of Auburn Heights, Mich. The new IH was purchased from the Detroit branch of Wolverine Tractor & Equipment Co.

TELFORD Equipment Co., Inc. of Detroit reports sale of an Adams model 330 Motor Grader to the city of Walled Lake, Michigan. The new Adams is powered by a Cummins diesel engine.

PENINSULAR Diesel Inc. of Detroit has installed a GM model 5033-7201 diesel engine in a Pettibone-Mulliken model 125-D loader. The installation was done for John Longo Co. of Detroit.

A 4½-yd. Michigan model 275A loader powered by a Cummins NTO-6-BI diesel was recently purchased by Tri-County Trucking Co. of Detroit. Sale was made by Miller Equipment Co. of Livonia, Mich.

D. E. Bolt Brothers of Flint, Mich. has accepted delivery on a new Allis-Chalmers model HD-6-E with hydraulic dozer blade. The unit was purchased from Earle Equipment Co.

WOLVERINE Tractor & Equipment Co. has delivered an International model TD-9 with Drott 4-in-1 attachment to Louis Pighin of Wyandotte, Mich.

A 2½-yd. Pettibone-Mulliken model 240 front-end loader powered by a GM 3-71 diesel engine was recently delivered to Dryer Brothers, of Midland, Mich. Sale was by Cyril J. Burke, Inc.

THE City of Livonia (Mich.) has accepted delivery on an Allis-Chalmers model TL-14DA (1½-yd.) front-end loader. The unit was supplied by Earle Equipment Co.

THE Grand Rapids office of Wolverine Tractor & Equipment Co. reports sale of an International model TD-9 bulldozer to Henry Koster of Jenison, Mich.

A Case model 1000 crawler-loader (2 yd.) powered by a Continental JD-382, 100 hp diesel engine was recently delivered to George Bradley of Pontiac, Mich. The new Case will be used in handling sand and was purchased from J. R. Panelli Equipment Co. Southfield.

CUMMINS Diesel Michigan Inc. of Dearborn, Mich. reports the installation of a 200 kw standby generator set powered by a VT-12 Turbodiesel Cummins engine. The unit was purchased for the K. I. Sawyer Air Force Base at Gwinn, Mich.

THE city of Wyandotte, Mich. has accepted delivery on an International model TD-9 crawler with a Drott 4-in-1 attachment. Sale was made by Wolverine Tractor & Equipment Co.

MOLE Construction Co. of Taylor, Mich. has accepted delivery on a Case model W-3 wheel-type loader (18 cu. ft.) The loader is powered by a Case 188 diesel engine rated at 52 hp at 2100 rpm and was purchased from J. R. Panelli Equipment Co. of Southfield.

FRANK Peterman of Kalamazoo, Mich. has accepted delivery on an International TD-6 crawler. Sale was made by Wolverine Tractor & Equipment Co.

PENINSULAR Diesel Inc. has installed a GM 4057C diesel engine in a Galion grader for the Ottowa county road commission of Grand Haven, Mich.

BAY County Road Commission of Bay City, Mich. has accepted delivery on a Galion 118 motor grader. The new Galion is powered by a GM 4-71 diesel engine and was purchased from Wolverine Tractor & Equipment Co.

R. G. Moeller Co. of Detroit reports the sale of an Austin-Western Pacer model 100 grader. The unit is powered by a GM 3-71 diesel engine with torque converter and was purchased by Michigan State University at East Lansing.

L. J. L. Trucking Co. of Richmond, Michigan has accepted delivery on a Case model W-12 (2½-yd.) loader. J. R. Panelli Equipment Co., supplier of the new Case, reports that it is now being used to load over 400 tons of aggregates per hour for McGinnis Brothers of Fairview, Mich.

EMD Sales Appointments

Two appointments were announced recently in the sales department of Electro-Motive Division, General Motors. Leroy R. Beck has been promoted from technical engineer in the service department to sales engineer. Mr. Beck joined Electro-Motive as an operating instructor in 1947 and was named a technical engineer in 1956. Norman C. Steinberger has been transferred to the product application section as an application engineer. He formerly was senior project engineer in the engineering department.

Exchanger Bulletin

A bulletin on hi-transfer heat exchangers made by Whitlock Manufacturing Co., is available. The four page bulletin, in three colors on heavy stock, lists stock sizes, dimensions and weights of the units made by the firm. Whitlock HT exchangers are available in single, two and four pass models. The bulletin also has dimensional drawings of seven of the units. To obtain a copy of bulletin 1895 write the Advertising Department, Whitlock Manufacturing Co., West Hartford 10, Conn.

New Sales Manager

Appointment of James F. Fenske as manager of sales has been announced by Allis-Chalmers Norwood (Ohio) Works electrical department. Fenske had been manager of the department's industrial sales and has been with Allis-Chalmers since 1948. He is a graduate engineer of the University of Cincinnati.

A-C Names Three

Newly named to the service department of Allis-Chalmers Industries Group are Lee G. Ingwersen, Robert W. Sherwood, and Samuel L. Soloff. Ingwersen is a graduate mechanical engineer of the State University of Iowa; Sherwood is a graduate industrial engineer of Georgia Institute of Technology, and Soloff obtained his mechanical engineering degree from Alabama Polytechnic Institute. The three men recently completed Allis-Chalmers training course for graduate engineers.

Lycoming Operations V.P.

Walker G. Dollmeyer, former vice president and director of Solar Aircraft Co., has been named to the newly created position of vice president of operations for Lycoming Division's Stratford (Conn.) plant. A graduate engineer of the University of Wisconsin, Mr. Dollmeyer has had more than 35 years experience in industry, including more than 11 years in the aircraft and missile field. Lycoming's Stratford plant is now engaged in the production of re-entry vehicles for the Atlas, Titan and Minuteman missiles, as well as gas turbine engines for helicopters and fixed wing aircraft. Mr. Dollmeyer's appointment was made effective immediately. Mr. Dollmeyer joined Solar in San Diego in 1956.

Hercules Factory Branch

Hercules Motors Corp. has announced the opening of its new Philadelphia factory branch. Simultaneously, President P. O. Peterson announced appointment of Burt Vodden as branch manager. The new Philadelphia sales and service headquarters—combining with it the former Hall-Scott Upper Darby Division—will serve users of Hercules diesel engines in southeastern Pennsylvania and southern New Jersey. It will also serve Hercules distributors along the entire eastern seaboard.

Named to TRW Post

Irwin A. Binder has been named vice president—Main Plant Operations, for the automotive divisions of Thompson Ramo Wooldridge Inc. For the past three years he has been serving as vice president, manufacturing, for the company's Ramo-Wooldridge division in Los Angeles and Denver, where he established and directed manufacturing operations. In his new post, Binder has direct responsibility for the light metals, motor equipment manufacturing and hydraulic products operations, and property management for the entire main plant area. Binder started with TRW 30 years ago following graduation from Case Institute of Technology with a BS degree in metallurgy.

Metal Hose Brochure

A new 20 page catalog, describing Universal all-metal flexible hose to convey gases, solids and fluids; for vibration control; and to compensate for motion or misalignment under high temperature, pressure, or other conditions, has been released by Universal Metal Hose Co. Detailed descriptions, specifications, and applications-use together with coupling recommendations, are given for the Universal U-200 and U-250 series for conveying searching gases and fluids like steam, hot oil, gasoline, liquified gases, refrigerants, chemicals, etc., where completely leak-proof hose construction is essential. Also included in the new catalog are Universal general purpose industrial hose, and hoses in the U-150 series. Copies of Universal catalog No. ID-100D can be obtained by writing Universal Metal Hose Co., 2133 South Kedzie Ave., Chicago 23, Ill. (ITS NEW)

25 Year Award

For 25 years of continuous service Robert L. Burpee, manager of Detroit Diesel's regional office in San Francisco, Calif. recently received that Division's 25-year certificate of service award and a personally engraved wrist watch in commemoration of the event. Starting with General Motors in 1935 in GM's Overseas Operations Division, Mr. Burpee has served in various positions until 1956 when Detroit Diesel expanded its administrative sales and service facilities by establishing regional offices throughout the country. He was selected to be manager of the Western Region with offices in San Francisco, California and this is the position he now holds with Detroit Diesel.

American Bosch Realigns Commercial Sales Positions

A realignment of sales responsibilities in the staff organization of the Commercial Sales Division of American Bosch Arma Corp. has been announced. Under the new organizational setup, all domestic and export field sales activities have been grouped under a newly established Field Operations Department. Headquarters sales office services in Springfield, Mass., will function under a newly created Planning and Administration Department. Four product managers have also been named. In charge of all field sales activities including the

L. C. Brendel

Bert Cole

Division's regional sales offices will be Lynn C. Brendel, manager of field operations. He will be assisted by Leslie R. Sarna as assistant manager, field operations. Mr. Brendel was formerly general sales manager of Allen Electric and Equipment Co. of Kalamazoo, Mich., having joined that company in 1946. Mr. Sarna has been with American Bosch since 1941 and has held various sales supervisory posts with the company. His most recent capacity was that of manager of sales services. Bert Cole has been appointed planning and administration manager. Mr. Cole joined American Bosch Arma in 1957 and has been serving in an executive capacity in commercial sales activities since that date. Appointed Product Managers are Kenneth O. Larson, diesel products manager; James D. Dowdell, electrical products manager; A. John St. George, Ensign products manager; and John R. O'Donnell, hydraulic products manager.

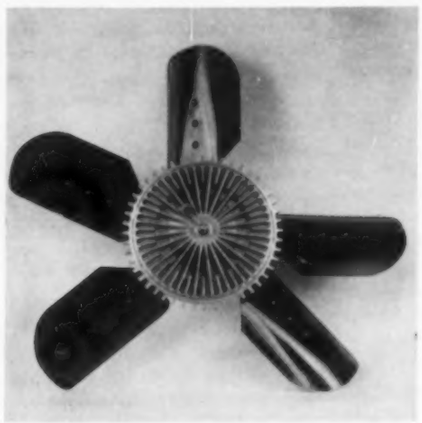
New Power Takeoff

Clark Equipment Co.'s Automotive Division has started production of a new type power takeoff unit that can deliver 70 hp without requiring changes in other power train components. Designated the P-200 flywheel power takeoff, the new design bolts to the engine flywheel housing, thus is ahead and independent of the clutch and transmission. Primary applications are vehicles such as transit concrete mixers, fire trucks, fuel trucks and farm equipment where large amounts of engine power are required to drive accessories, Clark designers point out. The takeoff is readily adapted to any engine with either SAE No. 2 or SAE No. 3 bell housings. It adds only eight inches to the power train lengths. Two speed ratios—1.27-to-1 and 1-to-1—are available in standard production models. Power is transmitted from the engine to the vehicle clutch and transmission by a shaft running the length of the takeoff unit and through a gear train to the power takeoff output shaft. Complete specifications of the P-200 Flywheel Power Takeoff can be obtained by writing to Clark Equipment Co., Automotive Division, Jackson, Mich.

ITS NEW

Controllable Speed Fan

A controllable speed fan that is both temperature and speed sensitive is a product of the Valve Division of Thompson Ramo Wooldridge Inc. The low cost fan is entirely self contained and will engage or disengage on demand, depending on speed and temperature conditions. The design, basically is of the viscous clutch type with a temperature sensing



device incorporated in the housing. The clutch plate is attached directly to the driving shaft and thus always operates at water pump speed. The housing forms the base for the fan blades and its rotational speed depends upon the fluid engagement between the housing and clutch plate, clutch slippage being one of the controlling factors so far as speed sensitivity is concerned. Temperature variations directly control the volume of fluid between the plate and housing. As radiator discharge air temperature increases, a greater amount of fluid will be permitted to remain in the clutch chamber, maintaining the fan in engagement over the entire speed range of the engine with a desired maximum speed established. As the temperature of radiator discharge air declines, the volume of fluid in the clutch cavity will be reduced, reducing the efficiency of the clutch and thereby dropping the fan speed to a minimum level. When operating conditions (engine speed and temperature) demand cooling effort by the fan, the device will remain in relatively equal engagement as a direct drive unit. At a predetermined maximum speed level, the multiple effect of slippage and the fluid volume in the clutch plate area will overcome the called-for engagement by the temperature sensing device and limit fan speed to a desired level. Correspondingly, when no cooling effort is required by the fan, fluid will pass out of the clutch area reducing fan speed to a minimum level. An important advantage of this type of fan is its effectiveness in reducing fan noise through actual disengagement under certain conditions. For more information write Valve Division, Thompson Ramo Wooldridge, 1455 E. 185th St., Cleveland 10, O. (ITS NEW)

Silencer Sales Executives

The Industrial Silencer Division of Burgess-Manning Co., Dallas, has announced the promotions of William A. Carroll, Jr., from sales manager to manager of marketing, and R. F. Oliver, Jr., former New York district sales manager, to sales manager for domestic operations. Carroll will coordinate over-all sales activities, including a newly-established international operation. A long-time employee of the company, Carroll began in the engineering department and later transferred to the sales department. He, too, was formerly district sales manager for the company in New York, and now resides in Dallas.

W. A. Carroll, Jr.

R. T. Oliver, Jr.

Largest A.D.S. Convention

The largest convention attendance to date was recorded by the Association of Diesel Specialists at their national convention, September 22-25 at the Sherman Hotel in Chicago. According to Mr. S. E. Franklin, Diesel Control Corp., Wilmington, Calif., and secretary of the association, delegates included representatives from Canada, Mexico and England. An innovation at this year's meeting was a series of service seminars, which were conducted by manufacturing members of A.D.S. Mr. James N. Britton, Hartford Machine Screw Co. and chairman of the seminars, reports attendance was above expectations and plans are already underway to provide larger meeting rooms for next year. Manufacturers conducting seminars were: C.A.V. Fuel Injection Equipment, Cleveland, O.; Scintilla Division, Bendix Aviation Corp., Sidney, N.Y.; American Bosch Corp., Springfield, Mass.; Hartford Machine Screw Co., Hartford, Conn.; Robert Bosch Corp., Long Island City, N.Y.; and Simms Motor Units, Ltd., London, England. According to an announcement by Mr. H. B. Sirotek, president of the association, and president of the Illinois Auto Electric Company in Chicago, headquarters and executive offices for the association have been moved to 633 E. 63rd Street, Kansas City 10, Missouri. Simultaneously with this announcement came appointment of Martin Fromm, Martin Fromm & Associates, Kansas City, as executive director of A.D.S. Mr. Dwight H. Barrett will serve as administrative assistant. In announcing the establishment of new headquarters and in explaining Mr. Fromm's appointment, Mr. Sirotek explained that the rapid growth of the Association has now made it necessary for A.D.S. to avail itself of professional association management services, as offered through the nationally-known firm of Martin Fromm & Associates. Mr. Fromm's Kansas City based agency has served as public relations counsellors to A.D.S. for the past four months.

Fuel Additive Booklet

Overall improved performance from every type of internal combustion engine through the use of the firm's fuel and oil additive is the topic of a six-page booklet, "L-X—The Power Releasing Supplement," published by Lubrication Engineers, Inc. Results achieved through L-X, the booklet points out, have been proved in both laboratory and field tests by the American Research and Testing Laboratories of Chicago. The ARTL tests show that L-X will reduce friction up to 12.16 per cent, reduce acid wear up to 30.05 per cent, reduce fuel consumption (variable), reduce oil consumption (variable); and reduce carbon formation up to 59.1 per cent. The fuel and oil supplement is blended from nine oils and chemicals, and included in the booklet is a section devoted to describing the functions of each of the oils and chemicals used in the product. Additionally, the booklet gives instructions on how to effectively unstick hydraulic valves and instructions for applying chemical tune-ups to tractor and truck engines. Also included are instructions for using L-X in all types of internal combustion engines—diesel, LPG and natural gas-powered engines. Another section of the book is devoted to a "fact list" pointing up other advantages of the additive. Copies of the booklet are available from Lubrication Engineers, Inc., 2809 Race St., Ft. Worth, Tex. (ITS NEW)

White Diesel Representative

Lou C. Michie has recently joined the White Diesel Engine Division, The White Motor Co., as sales representative covering the St. Louis and Chicago areas. He will be headquartered in the St. Louis area, and will handle both stationary and marine engines, and will cover inland waterways from Memphis to Pittsburgh and to Chicago.

Adm. Radford on Board

Admiral Arthur W. Radford, USN, Ret., former chairman of the joint chiefs of staff, has joined the board of directors of American Marc, Inc. Adm. Radford will also act in an advisory capacity in connection with the company's development and production of its small, lightweight diesel engines and diesel-generator sets. He retired as chairman of the joint chiefs of staff in August, 1957.

Induction Hardened Axles Standard on Some I-H Models

Use of induction hardened axle shafts as a standard component has been extended to cover all International trucks with full-floating rear axles from 4,200 to 30,000 lbs. gvw, it was announced by L. W. Pierson, manager of motor truck sales for International Harvester Co. They also are being used in optional two-speed axles in medium-duty International chassis. "These induction hardened axle shafts are ten times stronger than conventional through-hardened axle shafts and have a 30 to 40 per cent greater capacity to withstand fatigue," Pierson said. He added that engineering tests show the induction hardened shafts will deliver an average life 12 times longer than that of a through-hardened shaft. The induction hardening method of applying exceptionally high heat to outer surfaces creates excellent torsional characteristics with an extremely hard outer layer, while retaining a tough and resilient inner core. This process reduces shaft vulnerability to spline-end breakage.

Inland River Reports

By A. D. Burroughs

COLUMBUS Day christening ceremonies at St. Louis for the *America* created comment along all inland rivers. The 9,000 hp craft, celebrated as the most powerful inland river towboat ever built in the world, was delivered by St. Louis Shipbuilding and Steel Co., for Federal Barge Lines. Four Cooper-Bessemer engines supply the push power.

ANOTHER St. Louis Shipbuilding and Steel Co. product is in action at the Cairo terminal. The new 55 x 22 ft. towboat *Bill Wolter* serves Cairo Terminal and Fleeting Co., with 600 hp provided by two Caterpillar engines.

HUMBOLDT Boat Service, St. Louis, has made delivery of the 50 x 18 ft. towboat, the *Cipsco*, to Central Illinois Public Service Co., Meredosia, Ill. A Humboldt "skyscraper pilothouse" boat, the craft is equipped with twin Caterpillar model D333 engines developing a total 350 hp.

TODD (Houston) Shipyard delivered the new hydraulic dredge *Alaska* to Great Lakes Dredge and Dock Co. The 208 ft. vessel is equipped with three GM (Cleveland) 16-498 engines for main power. Fairbanks-Morse pumps and Ellicott dredge pumps, are on the equipment listing for this big dredge.

THE new U.S. Coast Guard patrol boat, *CG 65501-D*, delivered by Platzer Shipyards, Houston, is scheduled for Tennessee River service. The air-conditioned 65.8 x 21 ft. craft is equipped with 630 hp from Waukesha engines supplied by Waukesha Sales and Service, Houston.

FOUR 12 cylinder Alco model 251 engines power the 6500 hp towboat, the $1,500,000 *Patrick Calhoun, Jr.* The 190 ft. craft, largest ever built at Jeffersonville (Ind.) Boat and Machine Co., will serve American Commercial Barge Lines on the Ohio and Mississippi Rivers.

THE *J. E. Alquist*, reportedly an identical twin-sister craft to the *Patrick Calhoun, Jr.* is receiving the final inspectional touches for immediate delivery.

MODEL D-342 Caterpillar engines supply the push power for the new towboat, *Razorback*. Built by Bludworth Shipyard, delivered to Bacon Towing Co., the 46 x 16 ft. craft serves between Galveston and Houston.

JESSE Norris, a rare river production by the east coast shipyard, Gibbs Corp., Jacksonville, Fla., is in service on the Mississippi River for Jack Neilson, N. Orleans. The 64 x 20½ ft. towboat has a rated 1000 hp supplied from two Caterpillar model D353 turbocharged engines.

A Baldwin-Lima-Hamilton engine will boost the rated power from 1500 to 3000 hp for the dredge *St. Louis*. Owned by Missouri Dredging Co., the power will perform in the New Orleans area.

HARMS Inland Tugs, Inc., Orange, Texas, has a new fleet addition, a pusher-type tug, *Sea Gull*. Completed by Gulfport Shipbuilding Corp., Port Arthur, Texas, the 45 x 18 ft. craft has a rated 330 hp from two GM (Detroit) 6-71 engines.

THE *Franklin D. Roosevelt*, famous for pushing the first Federal Barge Lines tow up the Missouri River to Kansas City in 1935, has been sold by S. and S. Marine Towing Co., Joliet, Ill., to Point Towing Co., W. Va. The 148 ft. 7 in. x 40 ft. towboat has 1180 hp supplied by two McIntosh and Seymour engines.

New Quarters

A. Moe & Co., Inc., a Philadelphia ship and engine repair firm, has recently completed a move to a new machine shop and metal fabrication facilities. Working area, now consolidated in one location, has been more than doubled. Other advantages are better access to all parts of the waterfront and superior loading and unloading accommodations.

Roller Chain Ratings

The Association of Roller and Silent Chain Manufacturers has announced publication of new horsepower ratings applicable to American roller chains. The complete horsepower ratings listed in this book are an indispensible aid in design because they greatly expand the application field for roller chain drives and open the way for more horsepower per chain dollar. These ratings represent the results of research sponsored by the Association of Roller and Silent Chain Manufacturers in which studies were made of roller impact forces, dynamic tension forces, efficiency and wear life. For more information write the Association of Roller and Silent Chain Manufacturers, Uptown Station, P.O. Box 55247, Indianapolis 5, Ind.

Engineering V.P.

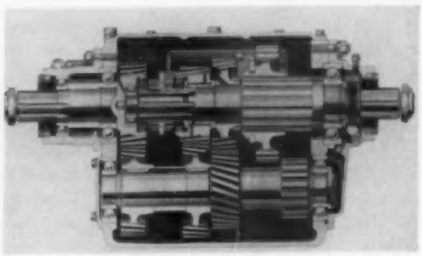
John W. Gravdahl has been appointed Vice President in charge of engineering of A. Moe & Co., Inc., ship and engine repair firm of Philadelphia. A graduate of the U.S. Merchant Marine Academy and the Brooklyn Polytechnic Institute, Gravdahl was formerly with Gibbs & Cox, Inc. and the Hoboken Division of Todd Shipyards Corp.

Describe Military Products

"Onan Military Products Capabilities" is the title of a 24 page booklet which provides information covering Onan experience, products and facilities and outlines the formative years of the company. During the war years, the booklet states, D. W. Onan & Sons Inc., built a greater number of field electric power units for military service than any other manufacturer in the United States. The military designation of these units, their rating, the major procurement agency and quantity produced are listed in detail. Military products designed and produced for government agencies since the war years are also listed by rating and number produced. A variety of new Onan products, both standard, or modified and developed for military service, are described and illustrated in the booklet. These include engine-driven electric generating sets, air-cooled engines, engine-driven refrigeration equipment (engine-compressors) and separate electric generators. This two-color plastic-bound brochure is available, free of charge, to all officials of government procurement agencies interested in military equipment of this nature and to consulting, design and electrical engineers engaged in both prime and subcontracts involving military and/or government applications. Write the manufacturer, D. W. Onan & Sons Inc., 2515 University Avenue S.E., Minneapolis 14, Minn. (ITS NEW)

New Auxiliary Transmissions

Two new four-speed auxiliary transmissions for medium and heavy duty trucks and tractors have been announced by Fuller Manufacturing Co. The 4-B-73 and 4-B-75 auxiliaries are designed to meet the needs of operators who in the past have been forced to pay a premium price for 4-speed auxiliaries which are designed for more capacity than their operations require. With overdrive, direct, low and low-low in one compact, 375-pound unit, the new transmissions provide gear splitting ratios plus deep reduction. The 4-B-73 is designed for use with engines producing approximately 500-600 lb./ft. of torque. Use of special high-capacity bearings permits the 4-B-75 to be used with engines in the 600-700 lb./ft. torque class. Gears ratios for the new Fuller auxiliaries are: overdrive, .85; direct, 1.00; low, 1.24 and low-low, 2.22. For full details write Fuller Manufacturing Co., Transmission Division, Kalamazoo, Mich. (ITS NEW)

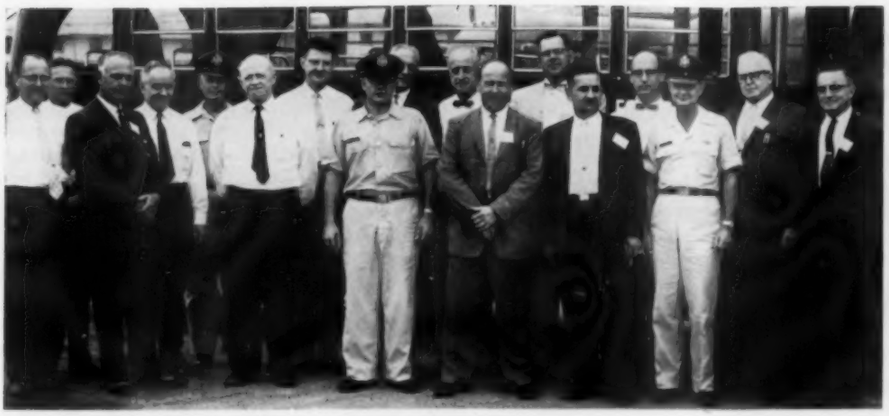


Cutaway view of the new Fuller 4-B-73 4-speed auxiliary transmission.

Volvo-Penta Sales Manager

R. L. Giles

Robert L. Giles has joined Volvo Import, Inc., Englewood Cliffs, N. J., as national sales manager, marine engines. He will head the importer's expanding distributor and O.E.M. sales organization handling the Volvo-Penta inboard-outboard marine power unit. Mr. Giles' experience includes recent assignments as a special marketing consultant. He formerly served as director of dealer development for the Kiekhaefer Corp., manufacturers of outboard motors.



DEMA Members Visit Air Base

Eleven members of the Diesel Engine Manufacturers Association accompanied by three officials from Headquarters, United States Air Force and one from Air Training Command visited Sheppard Air Force Base, Tex. recently where they observed training conducted by the Air Force especially in the electrical power production field. This training is conducted in the Power Production Branch of the Department of Utilities Training of the 3750th Technical School, USAF. The group came to Sheppard at the invitation of Maj. Gen. A. M. Minton, director of Civil Engineering, United States Air Force Headquarters. Their main interest was to see the operation of the school for power production operators and repairmen. They visited all phases pertaining to the diesel electric generation and associated equipment, and the other two branches of the Department of Utilities Training which are the Refrigeration and Building Trades. The group also toured the Department of Missile Training observing the correlation of the two departments. Members of the Diesel Engine Manufacturers Association are shown with Air Force leaders during their visit. From left to right are R. L. Stanley, executive director of DEMA; T. D. Byars from Deputy Chief of Staff/Technical Training, Headquarters, Air Training Command; M. Wall of Nordberg Manufacturing Co.; E. G. Huber, diesel engineer and Lt. Col. A. L. Pierce, both of Headquarters United States Air Force; W. T. Malone of Cooper Bessemer Corp.; H. P. Yount of Worthington Corp.; Capt. H. W. Poos of Sheppard AFB, N. N. Biddle, Cleveland Diesel Engine Division of General Motors Corp.; F. Troughton of Fairbanks, Morse and Co.; R. L. Smith of Chicago Pneumatic Tool Co.; W. A. Marx of Fairbanks, Morse and Co.; R. Gibson of Nordberg Manufacturing Co.; B. Roggins, Enterprise Engine and Machinery Co.; Captain Theodore Cline of Sheppard; G. J. Cleary of Headquarters USAF and E. L. Penwell of White Motor Co. (Official U.S. Air Force Photo)

F-M Sales Planning Assistant

J. W. Chandler

John W. Chandler has been promoted by Fairbanks, Morse & Co. to assistant for sales planning to the vice president, marketing, in the executive offices in Chicago. For the last year Mr. Chandler had been manager of the Fairbanks, Morse district office at St. Paul, Minn. He has been with the company since 1946, joining as an application engineer and rising to field engineer, then St. Paul diesel department manager.

Mid-West Diesel News

By L. H. Houck

FIRST Baptist Church, North Kansas City, a 60-ton air-conditioning unit with a model 135-GKU-426 Waukesha natural gas engine. Unit was fabricated and sold by AAA Engine & Electric, Inc., Kansas City, Kan.

MARION 35-M crane with 3-71 GM diesel engine to John Zehrer Construction Co., St. Louis, Mo., from Ryan Equipment Co., St. Louis.

MICHIGAN 175-A loader converted from gasoline to diesel by owners, Paul Polenska & Sons, Manchester, Wis., with a 4-71 GM diesel from Inland GM Diesel, Inc., Milwaukee.

FOR snow plowing in Walworth county, Wis., a 4-71 GM diesel from Inland GM Diesel, Inc. Walworth County Highway Dept., replaced a gasoline engine in an Oshkosh W703 truck, used for heavy trucking and snow work.

ALLIS-Chalmers model 145 motor grader with Allis-Chalmers D-344 diesel engine to Chas. Bussen Quarries, St. Genevieve, Mo., from Ryan Equipment Co., St. Louis.

GRADALL excavator, model 2460, self-propelled with J-6-1P Cummins diesel, with a DS-12 Oxy catalyst exhaust purifier to Allied Chemical Corp., Prairie DuRocher, Ill. Sale by Ryan Equipment Co., St. Louis.

GILBERT Helmkamp Excavating Co., Wood River, Ill., has purchased a model TL-20 Allis-Chalmers Tracto-Loader with Allis-Chalmers D-516 diesel engine, from Ryan Equipment Co. St. Louis.

GM 53's going strong. Inland GM Diesel, Inc., report two 4-53 GM diesels in Michigan 75A and 85A loaders sold in the Wisconsin area through Aring Equipment Co.

MURPHY diesels power the Cedarapids crush-plant of Elmer Larson, Inc., DeKalb, Ill., large aggregate producer of the Mid-West. A 133 hp Murphy is located at the George pit near Joliet and a Cedarapids double impeller impact breaker at the Sycamore, Ill., is operated by a continuous 203 hp Murphy diesel.

OBSERVED: McKiernan-Terry DE-30 diesel hammer in 60 ft. swinging leads, driving foundation piling on St. Louis river front job of MacDonald Construction Co. Site is being prepared for multi-million-dollar Jefferson Memorial project of the City of St. Louis.

INLAND GM Diesel, Inc., Milwaukee, has delivered a model 4031C GM 4-71 diesel industrial power unit to Burleigh Sand & Gravel Co., through Adams Machinery Co., Milwaukee. Unit will be used on a Cedarapids breaker.

ALLIS-Chalmers model DD motor grader with Allis-Chalmers D-262 diesel engine, to B&K Equipment Co., St. Louis, from Ryan Equipment Co.

RAY Reynolds Excavating & Grading Co., St. Louis, has taken delivery on an Allis-Chalmers HD-6G Tractor-Loader with D-344 A-C diesel.

TO A. & G. Excavating Co., St. Louis, two Allis-Chalmers model HD-6G's with D-344 diesel engines by Allis-Chalmers from Ryan Equipment Co.

MANITOWOC County, Wis., a GM model 3150 diesel standby unit and generator set—60 kw—for emergency service in the county convalescent home. Sale by Inland GM Diesel, Inc., Milwaukee.

INCREASED power for sawmill of Bert Grell, Gotham, Wis., who replaced a 4-71 GM diesel with a 6-71 from Inland GM Diesel, Inc.

MADISON, Wis., firm of Rein, Schultz & Dahl has taken delivery of a 4-71 GM diesel unit from Inland for powering a primary crusher.

GRANITE City Steel Co., Granite City, Ill., has taken delivery on an Allis-Chalmers TL-10 Tracto-Loader with model D-344 Allis-Chalmers diesel.

GENERAL Steel Casting Co., Granite City, Ill., a model HD-6G Allis-Chalmers with a D-344 from Ryan Equipment Co.

JOHN Bodine, St. Louis County, an Allis-Chalmers HD-1DC . tractor with model 16000 Allis-Chalmers diesel engine, from Ryan Equipment Co.

Heads Pump, Compressor Unit; Aides Named

Consolidation of the West Allis centrifugal pump department and the compressor department under the management of E. F. Greiwe has been announced by Allis-Chalmers. Greiwe, who had been manager of the Norwood (Ohio) Works centrifugal pump department since 1958, is succeeded by R. J. Dineen. Greiwe has been with Allis-Chalmers since 1936. He was manager of product sales, electrical department, Norwood Works, prior to being named manager of the pump department there. Dineen came to Allis-Chalmers in 1952 and was a sales representative in the central region before becoming manager for general products division sales in the firm's central region and, in 1959, manager, product sales, electrical department, Norwood Works, the post held at the time of his latest appointment. C. F. Codrington was named manager of sales and H. L. Ross, manager of engineering, for the newly consolidated pump and compressor department. Codrington had been manager of the compressor department since 1955, prior to which he was assistant to the manager of the blower and condenser section. Ross became manager of the West Allis centrifugal pump department in 1959. Prior to that he had been assistant manager and chief engineer.

Cooper-Bessemer Appointment

Appointment of John O. Fighter to the International Division office of The Cooper-Bessemer Corp. has been announced. The office is located in New York City. Replacing Mr. Fighter as branch manager of the Anaco, Venezuela office will be W. R. Bohannan, formerly a sales engineer at the firm's Caracas, Venezuela branch office.

Water Shortage Studied

Our most precious natural resource is water, yet many areas of the country are beginning to feel the pinch of water shortages. The feature article in the current issue of *Production Road*, external magazine of Twin Disc Clutch Co., examines the reasons for these shortages and spells out the measures needed to assure adequate water supplies throughout the nation. Another story describes a fascinating piece of machinery called a bridge launcher. This tank-mounted hydraulic unit is used by the Armed Forces to cross impassable gulleys and streams. There are also stories of interest to readers in the construction, logging, oilfield, and fishing industries. In addition, Twin Disc previews two new product lines—universal joints and power shift transmissions—in this issue. Copies of the magazine are available from the Editor, Production Road, Racine, Wis.

Florida Diesel News

By Ed Dennis

THE Jacksonville Branch of Detroit Diesel Div. GMC has moved into new quarters at 5040 Love Grove Road. The new building contains 13,500 sq. ft. for service and overhaul of GM diesels. Included in the new facilities is a 600 hp engine dynamometer. Their territory covers the northern half of Florida and the City of Tampa. Bart Patrick is manager and J. S. Powell service manager.

TWO models DSM 38 Enterprise diesel supply power for the two 460 kw Electric Products generators on the newly launched M V *Floridian* of Jacksonville. These 8 in. x 10 in. diesels are rated 575 hp at 720 rpm and have Woodward UG8 governors.

A model DD 149 Hercules four cycle, three cylinder 3¾ in. x 4½ in. diesel, powers the 15 kw Onan diesel generating set on the 62 ft. yacht *Lanran*.

REPORTS indicate that the City of St. Cloud is planning a $1-million expansion program to their water and power plant. And New Smyrna Beach is planning a $1.5-million bond issue to finance the purchase of new diesel units for their power plant.

IN the Tampa area the fishing boat *Miss Buckeye III* was repowered with two HR6M Cummins marine diesel engines. The engines are governed at 1800 rpm for a hp of 175 each. Also included were Twin Disc 508 2:1 r&r gears.

POWER Inc. of Fort Myers delivered a 10 kw Onan generating set, powered with a model OM 636 Mercedes Benz diesel engine to the Daytona Beach Boat Works for installation in a yacht.

ELLIS Diesel Sales & Service, at Fort Lauderdale, repowered the *Friendly Fish* a 54 ft. houseboat with two General Motors 6-71 marine diesel engines and 2:1 hydraulic r&r gears.

THE 50 ft. yacht *Curleu II* was recently repowered by a pair of the new model D311-H Caterpillar marine diesels and Capitol 2.5:1 r&r gears. The new Cats are rated 50 cont. hp at 2000 rpm and the installation was engineered by Shelley Tractor & Equipment Co. of Maimi.

THE *Hester* of Nassau had two, GM Cleveland Diesel, 3-268, 100 kw, diesel generating sets installed.

FOR the Bahamas, a TD-25 International Crawler tractor with the new DT-817 turbo-charged International 230 hp diesel engine, was delivered to R. T. Symonette of Nassau and a TD-9 International crawler tractor, 71 hp, for the Grand Bahama Club, Grand Bahama Island. Both from Florida Georgia Tractor Co., Miami.

TWO Lister-Blackstone diesels, model HB 3, having a bore and stroke of 4 x 4½ in. and rated 36 hp at 2000 rpm, were delivered to a Cutler Ridge housing project for pumping purposes by Shelley Tractor & Equipment Co., Miami.

THE Miami Br. Detroit Diesel Div. repowered a R 190 International truck with a model 4-53 diesel rated 82 net cont. bhp at 2200 rpm, for E. E. Collins, a contractor, and a 3-53 diesel rated 58 cont. hp, in a Chevrolet truck. Both replaced six cylinder gasoline engines and the original transmissions were used.

TWO Superior model 40-SX-8 diesels, rated 785 hp at 900 rpm, supply power for the two Marathon 550 kw 277/480 volt ac generators at the FAA Airway Traffic Control Center, Hilliard. Also included were Winslow lube oil filters, Airflex couplings (engine to generator), Young horizontal type radiators and Perry water filters.

AT Lakeland, N. L. Story, repowered two Diamond T 723 hiway tractors with Cummins C-180 diesel engines and placed an order for four additional Cummins diesels to repower similar tractors.

UP at Fort Pierce, the Hooper Construction Co. took delivery of a Caterpillar 619 two wheel tractor and scraper from Shelley Tractor & Equipment Co. who also delivered a similar rig to Calif. (Come and live in Florida) Construction Co. These new tractors are powered with the new Cat 225 hp turbocharged diesels, operate at 30 mph and pull a 14 yd. Cat 442 scraper.

HOWARD Johnson restaurant at Miami took delivery of a Diamond-T hiway tractor powered with a JT turbocharged Cummins diesel, rated 175 hp at 2600 rpm, and a Fuller transmission; seen at Edward Parkinson Co., Miami.

A Michigan model 280 tractor dozer powered with a Cummins NTO-6BI turbocharged diesel rated 262 hp at 2100 rpm plus a Clark torque converter and a Clark transmission went to Harris & Vaughn of La Belle for land clearing in Hendry County.

THE Belcher Towing Co. of Miami will take delivery of a 90 x 28 ft. tug in December from the American Marine Corp. of New Orleans. This twin screw tug will be powered by a pair of General Motors 567 diesels delivering 2000 hp, a 60 kw ac Delco generating set (6-71) and a GM dieselized fire pump will also be in the engine room.

TWO 30 kw generating units powered by model 135 DKBU Waukesha diesel engines for auxiliary power at Station #8 of the Central & Southern Florida Flood Control Project. The units came from Simplex Sales Co. of Miami.

AN International TD-15 crawler tractor with Drott 4-in-1 skid shovel for Citrus county road dept. The machine is powered with a 105 net hp diesel and Duval County has an International Harvester crawler tractor, TD-25, 230 hp, working.

New Anti-Freeze Product

Development of an anti-freeze that can be used safely year after year has been announced by the Du Pont Co. The new product—Telar anti-freeze and anti-rust coolant—while developed primarily for the automotive industry, is equally well suited to diesels. In addition to its long service factor, the product has another feature—a built-in signal that warns of major cooling system breakdowns. Called "Color Check," this exclusive, patented feature changes the normal red color of Telar to yellow if a leaky water pump, hose connection, or cylinder-head gasket lets too much air or corrosive exhaust gases into the anti-freeze solution, contaminating the coolant. According to Du Pont, the "staying power" of Telar is attributed to a new long-life chemical inhibitor that rustproofs the entire cooling system and protects all metal surfaces, including the latest aluminum alloys, against corrosion. The inhibitor forms a thin layer of "chemical armor" on all corrosion-susceptible surfaces that renders them immune to attack. When added to a system where rust and corrosion have already begun, the inhibitor prevents further damage.

ITS NEW

West Coast News

By James Joseph

TO Phillips Petroleum Co. for offshore drilling, three Caterpillar D397s, turbocharged with aftercoolers and driving 400 kw at 1200 rpm Electric Machinery generators. Sale by Shepherd Machinery Co., Whittier, Calif.

FOR the motor vessel *Ann B.* out of Seattle, an Allis-Chalmers 21000, 230 hp at 1800 rpm.

DELIVERED: an Allis Chalmers DAT-MR1125 marine diesel to Washington Fish & Oyster Co., to repower their M/V *Frostland*. Sale by Pacific Fishing & Trading Co., Seattle.

SOLD to Briggs-Conley-Dennis, constructors, for Denver Summit, Calif. highway project, a Caterpillar D333 turbocharged and aftercooled, driving 100 kw generator. Sale by San Leandro, Calif's Peterson Tractor Co.

FOR prime power at mine near Rabbit Hole, Nevada, a Caterpillar D337 turbocharged, driving 1800 rpm electric set.

TWO Western Ford engines (one 4 cylinder, one a 6 cylinder) have been delivered to Pacific American Fisheries, Squaw Harbor, Alaska, to power cannery pumps.

FOR a new 36 ft. cruiser, a 6 cylinder Western Ford diesel, installation by Carlson & Rowe, LaConner, Washington.

TO Mira Loma Hospital, Lancaster, Calif., as standby power, a Caterpillar D397 driving a 300 kw Kato generator.

FIRST two of perhaps 20 natural gas fueled Caterpillar G342s (225 hp @ 1200 rpm) driving deep-well Byron-Jackson pumps, to city of Diamond Bar, Calif., for powering domestic-industrial water supply. Newly developed city-site eventually plans five pump houses with four gas-fueled pump engines each. Sale: Shepherd Machinery Co., Los Angeles.

TWO Caterpillar D311 H marine diesels (60 hp continuous at 2000 rpm) have been sold to Michigan California Lumber Co., Camino, Calif. by Peterson Tractor Co., San Leandro. Engines power 16 ft. logging pond boats and drive thru existing Capitol reverse gears.

IN its continuing switch from gasoline to dieselization, truck-hauling Insured Transporters, Inc., headquartered in San Leandro, Calif. is now 80 per cent dieselized (since beginning the switch two years ago), recently added DBW-7012, 3-axle tractors with GMC 6V-71 engines (210 hp @ 2100 rpm) to its fleet.

DELIVERED: five Freightliner tractors with 220 hp Cummins diesels to Salt Lake-Kanab Freight Lines, Inc.

DELIVERED: to Newman and Malcolm, construction company a Hough Payloader powered with a Cummins C-175 turbodiesel (175 hp at 2500 rpm). Company headquarters in Van Nuys, Calif.

TO Ventura County (Calif.) road dept. a Galion road grader with a naturally aspirated Cummins JN-6, 130 hp at 2500 rpm.

SAN DIEGO (Calif.) County, has taken delivery of a Hough Payloader with a Cummins C-175 (175 hp at 2500 rpm) turbo-diesel, for off-road work. Sale by Cummins Service & Sales, Los Angeles.

FOR the yacht *Observer* owned by Douglas Oil Co., two Lister-Blackstone FR-4 (36 hp at 1800 rpm) heat-exchanger cooled diesels driving 20 kw Delco dc generators—as electrical supply. Sale by San Pedro's Bolstad Sales & Service.

AN air-cooled SL2 Lister-Blackstone driving 5 kw, 115 volt AC Winpower generator, sold to San Diego area farmer as light plant by R. D. Chapman Diesel Service, San Diego.

TO Side Botham & Sons, Wilmington, Calif., a Hough Payloader with Cummins JF-6 (110 hp at 2200 rpm) diesel.

TO the U. S. Navy's missile program: two SL2 Lister-Blackstone diesels driving 5 kw, 28 volt DC generators.

FOR Dun & Edwards Co., Los Angeles, big painting contractor supply company, the first of many SL-1Z Lister-Blackstone 1 cylinder air-cooled (1800 rpm, 1¼ hp) diesels, driving 23 cu. ft. Quincy trailer-mounted compressors, the "package" a new Dun & Edwards contractor assembly.

36 New Locomotives

The Electro-Motive Division of General Motors Corp., will supply 36 new diesel locomotives for the Chicago, Burlington & Quincy Railroad, according to an announcement by the railroad. The locomotives will be new GP-20s and are capable of hauling 100 car, 4500 ton trains at speeds up to 60 mph, according to the company. The order was part of one which also included 1,385 new freight cars.

C-B District Assistant

James R. Craine has been promoted to assistant manager of the East-Central sales district of The Cooper-Bessemer Corp. F. M. Devin, Cooper-Bessemer vice president and East Central district manager, made the announcement. Mr. Craine came to Cooper-Bessemer in 1952 as a sales engineer. He was promoted to branch manager of the Mount Vernon sales office in 1958.

ADVERTISERS' INDEX

25-ton payloads . . . yet off-highway trucks average 4 to 6,000 hours before overhaul

For the past four years, six Euclid 36 TD dump trucks have played a key part in Mountain Copper Co. of California's open-pit mining operations near Redding. Using RPM DELO Supercharged #3 Oil, this fleet has already worked more than 40,000 hours without a lubricant failure.

Operating conditions are tough for the "Eucs"; put a real strain on their engines. Hauling iron pyrite ore to the crusher plant and removing waste (above), they must travel loaded down 7% grades. Payloads range up to 25 tons . . . dust is thick . . . and temperatures reach 105° for six months of the year. Despite all this, the trucks work from 4,000 to 6,000 hours before engine overhaul.

"**We have no wear problems** at all using RPM DELO Supercharged #3," says Master Mechanic Ben Jacklin. "Never had any lubrication trouble in any engine using it. The oil's done an outstanding job in our equipment."

RPM DELO Oils reduce wear and prolong engine life because they cling to parts whether the engine is running or idle. Anti-oxidant fights gum and lacquer formation, special detergent keeps parts clean. Other additives prevent corrosion, crankcase foaming.

Why not try RPM DELO Oils? Let them cut your costs, lengthen equipment life. Just call your local representative, or write any company listed below:

RPM DELO

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey

STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA COMPANY, Denver, Colorado

R. H. Hertzberg, *Marine Supt., Cargo Carriers, Inc. (right) and R. B. Scott, Manager, Minneapolis Office, The Cooper-Bessemer Corporation discuss . . .*

How to move more ton-miles per horsepower

The Cooper-Bessemer-powered towboat Carcrosse has the answer. This 2400 hp boat of Cargo Carriers, Inc. has been setting records in the lower Mississippi, pushing more ton miles of cargo than any other boat her size. And, she is getting more ton-miles per horsepower installed.

The Carcrosse, shown here pushing 25,000 tons of grain, has been in almost uninterrupted service for 18 months, including ice breaking in winter months. She is equipped with two Cooper-Bessemer JS-8-T engines, each rated 1200 hp.

Check Cooper-Bessemer on how to assure top engine performance for the vessels *you* plan.

Cooper Bessemer

GENERAL OFFICES: MOUNT VERNON, OHIO

ENGINES: GAS - DIESEL - GAS-DIESEL
COMPRESSORS: RECIPROCATING AND CENTRIFUGAL
ENGINE, TURBINE OR MOTOR DRIVEN